

29 AUGUST 1988



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# **Science & Technology**

***China***

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## SCIENCE & TECHNOLOGY

### CHINA

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## SCIENCE & TECHNOLOGY POLICY

### Spending Increased on S&T Development, Basic Research

40080171 Tianjin JISHU SHICHANG BAO in Chinese 30 Apr 88 p 1

[Text] State Science and Technology Commission Deputy Director Ruan Chongwu the other day convened leading cadres from 57 ministries and commissions nationwide and announced the 1988 national scientific operating expense arrangements.

Operating funds for 1988 allocated by the State for S&T represent a small increase over last year. Budget quotas are categorized as to S&T development, social welfare, and basic research. None of the categories encroach on the others. Funding arrangements for S&T development are as follows: Based on last year's reduced appropriations there will be a further reduction of about 20 percent to 50 percent depending on conditions. Reductions will not be imposed equally. Those sectors with poor development capability or low levels of technology commercialization will be accorded special treatment. Two-thirds of the funds saved by a sector will be reallocated to that sector for use in funding industrial S&T work, to support the developmental work of S&T research organizations. The remaining one-third is to be used for S&T loans and will be entrusted to commercial bank and trust companies to be returned to the sectors in the form of low-interest loans which will be used to support S&T work of these research organizations.

Arrangements for funding of social benefits are as follows: Responsibility must be taken for surpluses or deficits in view of the fact that S&T operating expenses have increased slightly over the past year, and following the principles of linkage between funding and missions. In order to encourage this type of research organization to positively gear themselves toward economics and society, the 1988 income is not to be used for operating expenses, but is to constitute a S&T development fund, in its entirety to be retained by the organization

Arrangements for funding of basic research are as follows: Taking last year's amounts as a basis, regular operating expenses (accounting for about 70 percent) have increased slightly. The remaining 30 percent (research expenses) based on relevant regulations, originally should have been transferred to a foundation, but in order to support the progress of basic research, this year it is not planned to transfer these funds.

Apart from the above, according to the decision of the Coordination Conference of Central Financial and Economic Leading Groups, the natural science fund will increase from last year's 100 million yuan to 110 million yuan.

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## SCIENCE & TECHNOLOGY POLICY

Shenzhen Director Sees Increased Technical Cooperation Between Hong Kong, Shenzhen

40080131 Guangzhou GANG-AO JINGJI [HONG KONG & MACAO ECONOMIC DIGEST] in Chinese  
Apr 88 pp 24-25

[Article by Special Correspondent He Jiasheng [0149 0163 5116]: "Basis for Scientific and Technical Cooperation Between Shenzhen and Hong Kong--Interview With Shenzhen Science and Technology Industrial Park Director Zhang Yiyi [1728 5065 5065]"]

[Text] Bolstering scientific and technical cooperation between mainland China and Hong Kong to promote an upgrading of Hong Kong's industrial technology has become a hot topic of discussion. It was in this connection that the writer interviewed Shenzhen Science and Technology Industrial Park Company Director Zhang Yiyi.

When the park was first founded, the writer worked with Director Zhang for a time, forming a fast friendship. When old friends meet, naturally they are doubly cordial. After I explained my reason for coming, he took me to the walkway at his home to get a full view of the entire park area. For the sake of pioneering the brand new undertaking of a Chinese science and industrial park, this high-ranking engineer, with a fluent knowledge of German, left a warm home in Beijing to come to Shenzhen. He told me exuberantly that the industrial park that existed on blueprints had already begun to become a reality. He explained that on the north side was a long park housing applied chemical materials companies; on the east side lay approximately 18,000 square meters of two story general purpose factory buildings; in the middle was a large office building to the left front of which was a high quality apartment building; and in front of the building, where piles are being driven, would stand a building complex combining various kinds of scientific research, production, and offices in a construction area of approximately 18,000 square meters. The intention is to bring together here both international market needs and Chinese scientific and technical strength to translate China's scientific and technical achievements into production that could be promoted in international markets. On the western side where the land is in process of being leveled, a new industrial area will be opened. On the south side, a telephone branch office will be built.... In short, 1.2 square kilometers of the originally planned 3.2 square kilometer industrial park has already been build for use or is being developed.

When we returned to his residence, the writer asked Director Zhang about the earlier surveys and studies done in Hong Kong and Shenzhen about various problems in industrial cooperation between Shenzhen and Hong Kong. Director Zhang said that when planning began, a study was first made of the experiences of various countries in the world in the operation of science parks. All of them had been built with funds provided by local government treasuries, including Tsubuka Science City in Japan, the Kent [Kente] Hill [sic] Science and Technology Park in Singapore, and the Hsinchu Science and Technology Industrial Park in Taiwan Province. However, the Shenzhen Science and Technology Park is being developed and run by business organizations. Its highest authority is a management board, and Shenzhen mayor Li Hao [2621 3493] and Chinese Academy of Sciences director Zhou Guangzhao [0719 0342 0664] are respectively director and deputy director of the board. This form of organization has both the authoritativeness of government and the vitality of business. Practice has shown this to be a rather good form of administration and management. Second, it offers a perfect investment climate and provides fine conditions for making transfers in accordance with international standards for science and technology industrial parks. Not only is the industrial park's geographical location excellent and transportation readily available, but a lot of effort has also been put into internal administration "intangibles," the simplification of industrial park company structure, and the quality of personnel. Operating efficiency is high, and communications facilities are complete. All sorts of modern communications facilities are available for direct contact with Hong Kong, Singapore, Tokyo, and such international cities. Third, the science and technology industrial park has established a preliminary reputation. Not long ago, it joined the "International Science Park Association" in which it became a permanent member of the Asian-Pacific branch. In April 1988, it convened an international Science Park Association Asian-Pacific Branch conference in Shenzhen. This speck of land that cannot be seen on a map has begun to be recognized by others in the same line in the world, and it has obtained support from financial circles both in China and abroad. The large shareholders in the science and technology industrial park are Shenzhen City, the Chinese Academy of Sciences, and the Guangdong International Trust and Investment Company. In addition, Hong Kong financial groups also intend to provide support. Fourth, foreign investors and the industrial structure differ from other industrial areas of Shenzhen. The principal investors come from Singapore, Japan, and the United States, with the percentage from Hong Kong being relatively low. The industrial structure is made up primarily of the development of high technology wares, the emphasis being on the development of electronic information, optoelectronics, and sensor technology, on new materials, and on biological engineering. Products are geared to international markets, and are part of an international division of labor and international competition. They try to survive and develop in the great international economic milieu. This 3 square kilometer piece of land will both play a "model" role and be a "stronghold" for high technology cooperation between Shenzhen and Hong Kong.



At this point, Director Zhang drew a project schedule from his briefcase and gave a briefing. Artificial diamonds: a super hard material developed by the Zhengzhou "Three Abrasives" Research Institute; rare earths: using materials found in China's interior from development to separation, from primary products, to high quality rare earth products; microbiological engineering: hepatitis B vaccine; ammonium-iron-boron [sic] permanent magnet material; electronic computer soft disk drives, radiant crosslinked thermal contraction materials [sic], red aspergillus pigment, membrane separation and biological techniques, multi-script and multi-function typewriters, ceramics, porcelain and metal mold pouring and forming techniques, high frequency quartz vibrators, crystal cold processing, sensor technique development, aluminum alloy additives, catalytic converters for automobile exhausts, video magnetic drum storage devices, pocket x-ray diagnostic instruments, etc. Ten of these have already gone into production, and another 20 are being readied to go into production. Some of these projects will fill gaps in China's manufacturing, and others will produce articles for sale in international markets. With regard to the size of these businesses, Director Zhang said that most will be medium to small in size. Nevertheless, the trend of development shows the possibility that by 1990 there will be several leading projects with an output value of close to 100 million yuan, such as type B hepatitis vaccine, and rare earths products. These are primary level businesses. At the second level are medium size businesses, 20 of which will go into production during 1988, the number possibly reaching 40 by 1990. If 10 of them reach an annual output value of more than 10 million yuan, by 1990 output value will reach more than 100 million yuan. At the third level is mostly technical processing industries, and electronic component industries. At this point, the writer interrupted to say that recently we had conducted a survey in Hong Kong, Shenzhen and the Zhu Jiang Delta. The industrial structure of these three areas differs, particularly the components produced by electronic industries, and raw and processed materials for the plastics industry, which are imported from other countries or regions. Doesn't it seem that right now the industries that process and assemble imported materials in Shenzhen and the Zhu Jiang Delta are primarily extensions of Hong Kong industry? Director Zhang pondered a while and then said that this is unavoidable at the present stage. To use the language of the economists, this is an objective law of economic development. It was exactly for this reason that our science and technology park made the development of high technology its goal from the very beginning. If all the projects I mentioned above were to be categorized, electronic components and raw and processed materials would show up as being the focus for development. The difficulties involved in the development of such projects are truly very great, but we have surmounted the difficulties. Nevertheless, in proceeding from the strategic idea of "large input and large output," the industrial park cannot abandon the applied technologies that lie in between. This is particularly true in the case of electronic component industries, which are industries that combine labor intensivity and intensive technology and knowledge. In preparing to open the general technology industrial area, we welcome investment in the building of plants there to play a complementary and "supporting" role in Hong Kong's and Shenzhen's industrial development.

Finally, our conversation turned to the topic of technical cooperation between Shenzhen and Hong Kong industry. With regard to raising money for cooperation between high technology industries in Shenzhen and Hong Kong, Director Zhang said bluntly that naturally it was necessary to depend on government financial support. However, in view of the present state of financial revenues in Shenzhen City and the Hong Kong government's adoption of an industrial policy of "active non-interference," there is a limit to the funds that can come from governments. On the basis of experience in foreign countries, the greatest potential still lies in rousing the enthusiasm of the business world for the development of new technology. Large businesses in developed capitalist countries use approximately 10 percent of their gross sales receipts for the development of technology. The governments of both Shenzhen and Hong Kong should adopt policies that motivate and pressure businesses to develop new technology, that promote growth of technology markets, and that shorten the process whereby results of technological research are translated into commodities. The opening of technology markets in Shenzhen, and allowing businesses and technical personnel both in China and abroad to call for tenders and to submit tenders offers possibilities for spurring the commercialization of technological accomplishments, and it may raise large amounts of funds for the development of technology.

With regard to the exchange of personnel and market information for the development of science and technology in Shenzhen and Hong Kong, Director Zhang said that mainland China has ample scientific and technical forces and an abundance of talented people; however, for policy and organizational reasons, this has not been turned to full advantage. Hong Kong is tuned to market information; products are updated rapidly; and wide marketing channels are available. The Shenzhen special economic zone has an outstanding geographic location, and special policies and organization. By combining these three advantages, the Shenzhen special economic zone can, by virtue of its "attraction to the outside and links on the inside," play a role as a "window" for technology and knowledge between mainland China and Hong Kong. I believe that the strategic idea of "large input and large output" also applies to "large input and large output" of skilled personnel. Making the most of the strengths of both places, and introduction into the science and technology development field of international markets and vehicles for competition will make mainland China's scientific and technical personnel enthusiastic about the development of new technology, will promote the conversion of science and technology into productivity, and will enable mainland China's scientific and technical talent to make a new contribution to the technological upgrading of Hong Kong industry; and stabilizing the burgeoning of the Hong Kong economy. The Shenzhen Science and Technology Industrial Park will play a future role as an "intermediary," a "bridge," and a "base" for scientific and technical cooperation between the two areas and for turning to advantage the enthusiasm of mainland China's scientific and technical personnel.

Speaking about the nature of scientific and technical cooperation between Shenzhen and Hong Kong, Director Zhang said that there should be multiple forms of cooperation. First should be basic and complete cooperation of strategic

importance between the governments of the two areas with regard to the development of industry in the two areas and optimization of the investment climate. Second is vocational cooperation and the coordination of development. For example, Hong Kong currently has several large dominant industries, and in recent years some of these industries have spread and expanded greatly into Shenzhen and the Zhu Jiang Delta, mostly as a means of solving Hong Kong's labor shortage problem. In the coordination of the development of industries in the two areas, use should be made of the role of trade associations, and overall planning should be done to make research cooperative and complementary. Mainland China should make new breakthroughs in the development of electronic components and raw and processed materials so as to play an "invigorating" role for Hong Kong industry. Third is cooperative research and development on specific projects between enterprises in the two places, and between one enterprise and another. In this regard, the writer said that some academicians and businessmen in Hong Kong have proposed "research and development of imported prototypes." Director Zhang believed this could be easily done. The fastest way would be for mainland China research institutions or technical personnel to contract the research and development of specific projects, their economic returns being dependent on their research accomplishments. This would fully release the enthusiasm of mainland China scientific and technical personnel and make a contribution to the technological upgrading of Hong Kong's industry. At this point, Director Zhang said that whatever the form of cooperation, it would not be guided by international markets and take economic returns as the yardstick. Otherwise, cooperation could hardly be effective.

Finally, Director Zhang stressed the need for a wideranging dialogue at several levels between Shenzhen and Hong Kong for the purpose of providing the two governments policy advice. For example, the technological upgrading of Hong Kong industry, and the strengthening of scientific and technical cooperation between mainland China and Hong Kong has aroused the widespread interest of industrial, business, and academic circles. It is just this sort of issue that should be the subject of a wideranging dialogue between governments, among industrial and business circles, and among academic circles to provide advice to the government of the two areas. With regard to scientific and technical cooperation between the two areas, Director Zhang suggested that it might be possible for the Hong Kong Productivity Promotion Board or the Industry Office, and Shenzhen industry to take the lead in inviting participation by business and academic circles in both places for a wideranging solicitation of views in order to obtain a corresponding response that can be provided to the governments of both places as reference in the making of policies. This is also an important aspect of making policies scientific and democratic.

9432/08309

State Council Ratifies Key Points in Information Technology Development Policy

40080150a Beijing RENMIN RIBAO in Chinese 16 May 88 p 3

[Text] Beijing, 15 May (Xinhua News Agency)--The State Council has ratified key points in the Information Technology Development Policy as formulated by the State Science and Technology Commission and other departments. The State Council Office has recently issued these key points and is requesting that they be earnestly implemented throughout the country.

The newly formulated key points in the Information Technology Development Policy regard information technology to be the most active productive force of this age in the development of a world commodity economy. The use of information technology to improve the efficiency of the industrial and service sectors, promote scientific methods of management and decisionmaking, and advance development of a socialist commodity economy is a very important mission of China in the new historical period.

The "Key Points" (document) points out that regarding the development of information technology and an information industry, China already has achieved a certain scope and foundation. However, it is far from being able to adapt to the demands of establishing socialist modernization. The most serious problems which now exist are: investments have been inadequate for a long time; a critical lack of skilled personnel; backward technologies; and a gap between research and development and production. In most enterprises labor productivity and economic efficiency are low and the ability to develop independently is lacking, so that a competitive high-tech industry has not yet been formed.

The "Key Points" suggested that any attempt to seek out new routes for development must be based on a summary of historical experience and an analysis of world trends. It must also follow the laws of a socialist commodity economy and consider high technology and the special characteristics of high-tech industry development.

The "Key Points" emphasized the clarification of the overall policy of information technology development. The important provisions of this policy include designation of marketability and efficiency as targets and making a greater effort in developing the production of information technology products. Also, in the international competitive environment China's

information technology must be geared to both domestic and international markets. We must introduce advanced technology suited to the conditions of our country, using high-quality, low-cost foreign components, spare parts, and even some systems to greatly improve the ability of our information industry to create foreign exchange through exports. Simultaneously we must selectively implement proper protective measures conducive to the development of information technology applications as well as the development of information technology and industry. Priority development areas in information technology and industry must be selected, with efforts then being concentrated to promote them rapidly.

The fields of information technology to which China has assigned highest priority are: microcomputers with Chinese character processing capability and small microcomputer type systems; numerical program control exchange (technology); fiber optic and satellite communications technology and facilities; silicon analog integrated circuitry; silicon large-scale integrated circuitry design and production technology, and software engineering technology. Unified planning is essential to achieving coordinated development in microelectronics, communications, computer and software technologies, and essential to the realization of economies of scale and rationalization of production in the information industry. Within a specified period of time the country must adopt special, sound, preferential policies respecting taxation, credit, depreciation, etc. affecting enterprises and groups of enterprises within the information industry. Research and development of information technology must be strengthened and the creation of new technologies promoted. Information technology research and development is divided into two levels, one is oriented toward practical applications while the other is oriented toward the future. The former is the primary arena in information technology development and is closely linked to industry. Research and development in the latter must establish the requisite technical resources in such important fields as very large-scale integrated circuitry, super high-speed integrated circuits, synthesized digital business network technology, and artificial intelligence.

The "Key Points" indicated that utilization of information technology must advance into every sphere of economic and social development. Appropriate policies have been formulated concerning the development of an information technology service industry; increasing the ability of the information industry to create foreign exchange through export; encouragement of import substitutions; dissemination of knowledge about information technology; strengthening the cultivation of skilled personnel, and accurately handling the relationship between information sharing and the need to protect confidential information.

13466/6091

'Torch Plan' Aims To Promote Development of High-Tech Industries

40080150b Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 11 Jun 88 p 4

[Text] (Zhongxin News Agency)--Reporters today learned from the State Science and Technology Commission that relevant sectors are currently assembling specialists to accelerate the formulation of a high-tech industrial development plan to be dubbed "Torch."

The aim of the "Torch Plan" is to accelerate the commercialization of achievements in the laboratory which have come as a result of the National High-Tech Research and Development Plan implemented 1 year ago and to promote the formation and development of China's high-tech industry.

The High-Tech Research and Development Plan has also been called "China's Eureka Plan." This plan requires that in the next 10 years a concentration of scientific capability be established in seven fields including biotechnology, aerospace and new materials for the purpose of catching up with the most advanced scientific developments worldwide. Currently, there are already nearly 10,000 scientists participating in this plan. Not long ago a responsible official of the State Council indicated that development of high-tech research and industry will decide the global position and role of China for the next century.

According to Gan Shijun, deputy director of the National Research Center for Science and Technology Development [NRSTD], after several decades of effort, China's high-tech research has attained some major achievements and produced personnel skilled in high technology. In the next few years it may be expected that the value of China's high-tech industry will reach \$10 billion. However, because of China's long-standing lack of any natural mechanism for the commercialization of the fruits of high-tech research, high-tech industry development still faces difficulties.

Gan Shijun revealed that at the end of the year, people from relevant government departments, industrial, and scientific-technological circles will meet in Wuhan to participate in the High-Tech Industry Development Academic Conference and Product Exhibition, sponsored by the NRSTD, the China Computer Society, and other organizations. This conference, which is authorized by the State Science and Technology Commission, the Commission for Science, Technology, and Industry for National Defense, and the Chinese Academy of Sciences, will analyze and summarize foreign high-tech industry development experiences and their value for China, and will also study China's high-tech industry development strategy.

## SCIENCE & TECHNOLOGY POLICY

### Science-Technology Exchange Expands

40100035a Beijing XINHUA in English 0201 GMT 13 Jun 88

[Text] Beijing, July 22 (XINHUA)--China's scientific and technical co-operation and exchange with other countries are expanding, said a report in today's "CHINA DAILY."

To date, China and 106 other countries have concluded inter-governmental agreements for science and technology co-operation, and this year, there are some 10,000 joint or exchange projects under way between China and other countries, the paper said.

Since China began opening to the outside world in 1979, the government has taken measures to establish extensive co-operative and collaborative relations with many countries in the world, either at governmental or non-governmental levels, on a bilateral and multilateral basis, the paper said.

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SCIENCE & TECHNOLOGY POLICY

Earth Gravity Data Bank Established

40100035b Beijing XINHUA in English 0201 GMT 13 Jun 88

[Text] Beijing, July 12 (XINHUA)--A huge data bank on the earth's gravity fields has been set up in China, XINHUA learned today.

The data will play an important role in China's future space technology and will lead to an improvement in resolution of satellite pictures of the earth as well as more accurate missiles, which are affected by the gravity fields in the earth's atmosphere.

The bank is developed by a research institute under the Headquarters of the General Staff of Chinese People's Liberation Army.

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## SCIENCE & TECHNOLOGY POLICY

### Research Official Outlines High-Tech Gains

40100035c Beijing XINHUA in English 0201 GMT 13 Jun 88

[Text] Beijing, June 13 (XINHUA)--Chinese scientists, entrepreneurs and government officials will meet in Wuhan, Hubei Province, to work out a strategy to boost high-tech industry and the commercialization of high-tech achievements, CHINA DAILY reported today.

Gan Shijun, deputy director of the National Research Center for Science and Technology Development, which will sponsor the meeting, said there will be a second meeting to be held in December and it will study the status, environment, mechanism, management and policies of Chinese high-tech industries, which are just beginning to develop.

Participants also will study cooperation between high-tech and traditional industries, defence high-tech and the national economy, and look for the best ways to develop the high-tech industry.

Along with the meeting, there will be a high-tech products exhibition. Gan emphasized that these products will be ready for the market rather than models which cannot be put into mass production.

He said the production value of China's high-tech industry in the fields of electronics, new materials and biotechnology is expected to reach 10 billion U.S. dollars by 1990, accounting for one percent of the world market in these fields.

The current Chinese system lacks a mechanism to put research achievements into production and commercialization. That is because the country's high-tech research has long been military-oriented--building missiles, radar and satellites, he said.

He said China's high-tech personnel are very competent compared with those in most Third World countries in such fields as biology, space industry, information, lasers automation, energy, new materials and super-conductor technology.

China's current high-tech industries include those concerned with the military industry, production lines introduced from developed countries, and newborn high-tech enterprises.

He said China's high-tech development in the next 15 years is vital to its status in the world. Some high-tech plans are under way. China has made high-tech a key research project during the seventh five-year plan (1986-90) and has drawn up a high-tech research and development plan.

A meeting now being held in Nanjing by the Chinese Academy of Sciences reported that research institutes in Shanghai and Fujian Province have developed two optical crystals.

One of the crystals, known as bismuth germanite, has become in high demand on the world market and has earned some eight million U.S. dollars.

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## Policy on Technical Exchange Detailed

40100035d Beijing XINHUA in English 0201 GMT 13 Jun 88

[By staff reporter Ma Lixin]

[Text] China's scientific and technical exchanges with other countries have entered a new, more highly selective era.

These interchanges should either produce economic expertise or breakthroughs in advanced branches of science and technology.

Zhu Lilan, vice-minister of the State Science and Technology Commission (SSTC), told CHINA DAILY that the country's scientific and technical exchange with the outside world are still providing the lead for the nation's whole social and economic development, though there is more to be desired.

She said co-operative research and exchanges in science and technology, especially in the high-tech area, should be the precursor of economic development.

So, in the future, China not only will increase these kinds of exchanges with other countries at the academic level but also at a corporate level, she said.

Concerning the expanding of cooperations and exchanges with the United States, the vice-minister said the planning is under way, but as yet there has not been much progress made in high-tech exchanges.

### Problems

One of the problems to be solved should be that of ownership of technical rights, as international co-operations in high-tech areas tend to be a very sensitive and monopolistic issue.

China's policy has always been that of equality and mutual benefits, she said, and China hopes the United States and other countries will be more open in high-tech exchanges.

China's scientific and technical co-operations and exchanges with West European nations have been good, Zhu said.

At present, China's high-tech export climate is not yet ready. But China has the advantages of vast numbers of individuals with advanced technical knowledge and of rich natural resources.

Since China began opening to the outside world in 1979, the government has taken measures to establish extensive co-operative and collaborative relations with many countries in the world, either at governmental or non-governmental levels, on a bilateral and multilateral basis.

To date, China and 106 other countries have concluded inter-governmental agreements for science and technology co-operation, according to Wu Yikang, director of the department of international co-operation of the SSTC.

This year, there are some 10,000 joint or exchange projects under way between China and other countries. The trend of co-operation and exchange looks promising, he said.

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Liaoning Conference Maps S&T Development Strategy

40080175b Tianjin TIANJIN RIBAO in Chinese 14 Jul 88 p 1

[Text] The provincial scientific and technological work conference which was cosponsored by the provincial party committee and the provincial government, opened at Liaoning Building on 14 June. The central points for discussion at this conference are ways to foster the strategic ideology of "invigorating Liaoning with science and technology" and ways to organize and mobilize the scientific and technological circles to contribute to developing Liaodong peninsula's export-oriented economy.

Quan Shuren, Li Changchun, Gao Zi, Ge Xifan, Cheng Jinxiang, Lin Sheng, Wen Shizhen, and Yue Weichun attended the conference. Also attending the conference were more than 200 people, including mayors and secretaries of various cities in charge of scientific and technological work; directors of planning and economic commissions and scientific and technological commissions; responsible comrades of provincial-level departments concerned; deputy county heads in charge of scientific and technological work; and representatives from colleges, universities, and scientific research units.

Vice Governor Wen Shizhen presided over the conference. Vice Governor Lin Sheng delivered a report at the conference on "firmly fostering a development strategy of invigorating Liaoning with science and technology, and on accelerating Liaodong peninsula's export-oriented economy." After reviewing our province's 10 years of achievements on the scientific and technological front, he stressed three issues.

First, it is necessary to foster the strategic ideology of "invigorating Liaoning with science and technology" in an effort to promote socioeconomic development. The present and future situations in Liaoning's economic development give us no choice but to think over a major and serious issue: What should we rely on in order to invigorate Liaoning? Should we rely on natural resources? Many of our natural resources are very limited. Should we rely on putting in large amount of funds and manpower? We have difficulties in this field. There is only one way out. That is, we must comprehensively promote scientific and technological progress and rely on it to invigorate Liaoning. In this connection, the provincial party committee and government have decided to consider "invigorating Liaoning with science and technology"

as the strategic ideology of the national economic and social development. The tentative plans for attaining the fighting goal of "invigorating Liaoning with science and technology" are: By the end of this century, the technical level of the major industrial production trade and spheres throughout the province should approach the level of 1980's of some economically developed countries; the level of scientific research should attain the level of the 1980's or early 1990's of some economically developed countries; the technical level of agricultural and other production departments should improve remarkably; the proportion of output value of some new-technology industries to the gross national product (GNP) should reach 5-8 percent; the share of factors of scientific progress in economic growth should increase from the present 30 percent to more than 50 percent; scientific, technological, economic and social sectors should be developed in a coordinated manner; economic results should rise continuously; the production set-up should be further rationalized; the total industrial and agricultural output value should be quadrupled; and the people's livelihood should become comparatively well off. The major strategic points of "invigorating Liaoning with science and technology" are to rely on scientific and technological progress to develop pillar industries and accelerate the transformation of traditional industries, to rely on scientific and technological progress to develop township enterprises and agriculture in order to create foreign exchange, to strengthen the study of new and high technology and develop newly booming industries, to conduct research of soft science and raise the level of policy-making and modern management, to strengthen international scientific and technological exchange and cooperation and narrow our gaps with developed countries, to create an environment in which the entire society supports scientific and technological progress, and to improve the entire nation's scientific and cultural quality.

Second, it is necessary to deepen reform and establish a new system under which science and technology are closely integrated with the economy. In the future, the major points of deepening scientific and technological structural reform are: All state-owned scientific research units should further introduce competition, promote all forms of the responsibility system in contract business operations, speed up the reform of the system of allocating scientific and technological funds, reform the traditional system of funds allocation, encourage scientific research units to directly participate in the economy, promote an integrated development of scientific research and production, further relax control over scientific and technical personnel, and encourage the people to support the development of state-run scientific research organs.

Third, the central task of scientific and technological work is to serve Liaodong peninsula's export-oriented economy. The current major tasks are: 1) We should rely on scientific and technological progress to advance a great number of large and medium-sized enterprises and township enterprises to the international market. Scientific research units at colleges and universities should develop different levels and various forms of cooperation with these enterprises. 2) We should actively develop and promote advanced and practical technology in an effort to enhance our ability to earn foreign exchange through exports. 3) We should study and develop new technology and establish the rising industries. 4) We should strengthen international scientific and technological cooperation and exchange and actively bring in intellectual resources from abroad. 5) We should actively conduct activities to popularize science and technology and enhance the scientific and technological awareness of the whole party and all the people.

Tianjin To Build High-Technology Complex

40080175a Shenyang LIAONING RIBAO in Chinese 15 Jun 88 p 1

[Text] A new technology industrial garden based on the industries of our municipality and supported by scientific research institutes will be established in our municipality. The feasibility study and the general designed framework for the garden was approved by experts on 13 July. They held that the research results of the project were highly valuable for their practical applicability. The new technology industrial garden will become an area where high technology and high intelligence are concentrated. A number of high-technology industrial groups will emerge in the garden.

Within a limited space, the high-technology industrial garden puts together 11 universities, 83 scientific research institutes, and 88 plants and enterprises, with the total number of scientific and technical personnel exceeding 27,000. The garden will become an area where knowledge, personnel, technology, funds, and information are highly concentrated; where scientific research, production, and education are closely integrated; and where technology, industry, and trade merge into an organic whole. It will be an area having conditions for production and everyday life and an ecological environment. Performing its social functions as an intelligence center of our municipality; a distributing center of science, technology, and personnel; and a base area of new high-technology industry, it will provide a good environment for developing high technology and commercializing other commodities.

Located in the southwest part of the city proper, the new technology industrial garden is divided into an eastern and western part. The eastern part covers an area of 9.6 square km, and its major functions are high-technology tracking and advancing research and applicable technology development. The western part covers an area of 4 square km, and will become a leading high-technology industrial development area with small and medium-sized pollution-free technology-intensive enterprises as the center. An "entrepreneur service center" will be established in the garden to conduct research and development of high-technology projects and to promote the development of scientific and technological enterprises equipped with various advanced technology or high technology. At the same time, a "scientific and technological street" will be built on Anshan West Road to support in a concentrated manner the scientific and technological tertiary industry engaged in technical consultation and equipment maintenance and to moderately develop high- and medium-grade everyday

services; create a good scientific and technological social environment; improve the infrastructural facilities for scientific and technical service; and build a scientific and technical service building to coordinate with the computer center, scientific and technological information center, the precision processing center, and other facilities within the garden to form a scientific research and technical service system. Development of the garden is divided into three stages. The period from now to 1990 is a beginning period for 3 to 5 years of development. By the early 21st century, it will enter a mature period for sustained and stable development and become one of the country's high-technology development bases.

Based on our municipality's advantages in the field of high technology, the new technology industrial garden will also conduct research emphatically on the three fields of material science, bioengineering, and the laser, machinery, and electronic industries and the integration of machinery and electronic industries.

At the 13 July meeting to appraise the feasibility study and plans for the garden, experts held that construction of the new technology industrial garden is a large project concerning the entire municipality and that concerted efforts of various fields are needed. The key to the formation and development of the garden lies in how to bring in a brand-new organizational management pattern, establish optimal operational mechanisms, and strengthen management of the garden with modern scientific methods at the beginning of the construction period.

/08309



### Breakthrough in Transonic Gas Turbine Research

40080147a Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 3, Mar 88, pp 31-32

[Article by Zhang Qinghua [1728 3237 5478] and Liu Xiaoan [0491 1321 1344]

[Text] The highly-loaded transonic turbine is an advanced technology of modern aircraft engines. This technology was only recently put into actual use in developed countries. According to recently published research reports, the major aircraft companies and many research and design institutes around the world are devoting a great deal of effort in the design and research of the highly-loaded transonic turbine.

There are two key issues involved in developing transonic turbine technology; i.e., advanced technology in aerodynamic design and advanced technology in cooling of the turbine blades. By using these new technologies, it is possible to reduce the number of stages of turbine components, reduce the engine weight, and thereby increase the engine thrust-to-weight ratio and lower its production and maintenance costs.

In the early 80's, the Chinese Aeronautical Establishment (CAE), in establishing a systematic research plan to develop high-performance propulsion systems, took the initiative to organize a team of experts engaged in the research and development of turbine aerodynamic and cooling technologies at research institutes, design institutes, universities and factories around the country, and began a concentrated study effort to develop advanced technologies for highly-loaded transonic turbines. After several years of dedicated effort, a major breakthrough has been achieved in the key issues of aerodynamic design and cooling technology of turbine blades for highly-loaded transonic turbines; a giant step was taken in the transition from subsonic to transonic turbine technology; and valuable research results were obtained. Experts believe that this technology is ready to emerge from the research and development stage to the stage of engineering implementation, and it is now comparable to the international standards of the 80's. This achievement has effectively saved 10 years of time in terms of narrowing the gap between China's turbine design technology and the technology of advanced nations. It has clearly provided technical and economic benefits to the development of China's aircraft engines.

In the integrated study, the Aviation Gas Turbine Research Institute has united the scientists and engineers of China's turbine research community to devote their energy to the following research topics:

1. Research of Transonic Planar Cascades. A computer program has been developed to facilitate the fabrication of transonic turbine blades with arbitrary surface defined by an analytical model. Valuable experience and engineering data have been obtained in the areas of cascade channel design, parameter selection, and selection of back profile of turbine blades. A large amount of data and curves have been recorded from wing tunnel tests of more than 20 transonic planar cascades; in addition, schlieren pictures and images have been taken over a wide range of test conditions to provide valuable information for further analysis and research. The test results show that the performance of the cascades is comparable to that of similar cascades built in the 70's by other countries. This achievement has laid a technical foundation for the aerodynamic design of transonic turbines. The research results have been successfully applied in the design of highly-loaded transonic turbines, and part of the research reports have been presented at international conferences.

2. Experimental Research of Highly-Loaded Transonic Turbines. Based on the design and test experience of subsonic turbines, a set of procedures were developed for designing transonic turbine stages. In a high performance turbine engine, boundary layer separation often occurs because of the high load in the high-pressure stages, the use of short blades and small aspect ratios, and the presence of a complex system of shockwaves in the mixed flow field. Therefore, achieving high stage efficiency is a very difficult problem. The design calculations for highly-loaded transonic turbine stages should be based on three-dimensional non-isentropic flow theory. In an effort to optimize the design parameters, a large amount of numerical calculations and a large number of tests were performed; large bendangle designs were used for both the guide blades and the work blades. In the process of blade fabrication, full advantage was taken of the experience and test data obtained from the design and test of transonic planar cascades with regard to such issues as the thickness of the blade trailing edge, the configuration of cascade flow channel, the shape of back blade profile, and the cascade density.

Based on the results of transonic aerodynamic design and cascade test, experimental studies of two single-stage turbine models were carried out.

The purpose of the first test was primarily to verify the design calculations and the blade fabrication methods. The test results showed that the work done by the single stage was equivalent to 1.72 times that of the first-stage high-pressure turbine of a Spey engine.

The second test involved an extensive study of turbine aerodynamics whose scope was unprecedented in this country. Specifically, in this study, new engineering methods for the aerodynamic design of transonic turbines and new methods of blade fabrication were developed; a prototype

design which met the aerodynamic performance requirement of high-pressure turbines was obtained; in addition, a large number of tests were carried out for the purpose of exploratory research. Examples of these tests included the wind tunnel test of planar cascades with typical cross sections, test of gas-water analogy, wind tunnel test of ring-shaped cascades, measurement of blade surface velocity, and tests to study the effect on stage performance by varying the gap of blade tip and the number of blades. These tests provided valuable information to guide further theoretical analysis, which in turn will stimulate China's research effort in transonic turbine aerodynamics.

The test results show that the stage load of the Chinese-designed transonic turbine is twice that of the high-pressure turbine of the Spey engine and the stage efficiency is higher than the average efficiencies of advanced transonic turbines built by other countries; in fact it is very close to the turbine efficiency of the U.S.-built E<sup>3</sup> energy-conserving engine. The two important parameters for evaluating the aerodynamic design of turbine stages are the stage load and the stage efficiency; in terms of these performance measures, the Chinese-built transonic turbine exceeds the average standard of similar turbines built in the 80's by other countries. Therefore, in this regard, China has entered the rank of advanced nations.

The attached figure shows a comparison of the stage efficiency characteristics of the Chinese-built highly-loaded transonic turbine with those of foreign-built transonic turbines. The figure shows that the efficiency of China's transonic turbine is quite satisfactory in terms of its extended flat range and its absolute magnitude.

3. Experimental Research of Air-Cooled Blades of High-Temperature Transonic Turbine. In addition to aerodynamic design, the CAE also organized the research and test efforts of another technology area; i.e., the technology of turbine blade cooling, and encouraging results were also obtained.

Specifically, by carrying out studies in the areas of fluid motion and heat transfer of typical internally-cooled structures, film cooling and impact cooling techniques, finite-element methods to calculate steady-state and transient temperature fields, and radiation heat exchange with the wall surface, a set of high-accuracy design algorithms and computer programs were developed. They were used to design two different guide blades and two different work blades with composite impact-convection-film cooling; in addition, new processing techniques such as non-residue precision casting and laser drilling were used to produce the test articles.

The test results showed that the cooling effect of all four air-cooled blades exceeded the design criteria; the cooling performance approached the performance of the air-cooled blades of the U.S.-built E<sup>3</sup> energy-conserving turbine. The gas temperature prior to entering the turbine can be raised to 1600°K or higher.

The design and development of the highly-loaded transonic turbine is a difficult research topic which involves many different scientific disciplines. Currently, only a small number of developed countries have a good grasp of this technology. However, by relying totally on their own ability, Chinese engineers were able to achieve a major breakthrough in this key technology area. This illustrates not only the talent but also the willpower of China's technical personnel.

Recently, experts in the aircraft turbine community held a conference in Suzhou City to exchange ideas in design technologies of the highly-loaded transonic turbines, to review the research accomplishments over the past few years, and to make preparation for meeting future challenges and achieving higher goals in this technology.

3012/12223

### New Airborne Synchronous Laser Rangefinder

40080147b Beijing GUOJI HANGKONG INTERNATIONAL AVIATION in Chinese No 3,  
Mar 88 pp 56, 44

[Article by Su Changshan [5685 7022 1472]

[Text] The airborne synchronous laser rangefinder designed and built by the Luoyang Electro-Optics Research Institute of the Chinese Aviation Technology Import/Export Company was successfully flight-tested and passed design certification in September 1987. This device is primarily used on attack aircraft for air-to-ground ranging; it provides high-precision range and position information for fire control systems to improve targetting accuracy of airborne weapons systems. It can also be used on bombers and military helicopters, as well as on ships and ground vehicles. In addition, it can be used to support aerial survey, terrain avoidance, and terrain following systems.

Development of the airborne synchronous laser rangefinder began in the early 80's and was divided into four stages: proof of concept, conceptual prototype design, experimental prototype design, and final prototype design. The prototype unit which participated in the design certification has undergone technical performance evaluation tests, environmental survival tests, as well as flight tests in accordance with national standards and regulations. The results showed that the unit met or exceeded the design requirements in terms of ranging capability and accuracy, repetition frequency, and synchronization accuracy. As a result, the targetting accuracy of the airborne weapons system is greatly improved; in particular, with the laser rangefinder, it is possible to achieve the same accuracy for targets located on a mountain with unknown elevation as for targets on a plain.

### System Components and Technical Performance

The airborne synchronous laser rangefinder has five main components: the laser transmitter/receiver, the power source for the transmitter, the range data processor, the cooling unit and the servo amplifier (see picture on center insert). The laser transmitter/receiver is partially embedded in the lower part of the aircraft fuselage; the laser window is

exposed to the outside of the aircraft to facilitate laser transmission and reception. The servo amplifier performs the function of target scanning and tracking by amplifying the target position information obtained from the fire control computer, and driving the optical mechanism to control the laser beam.

The rangefinder uses a 1.064-micron Nd:YAG laser with a pulse repetition frequency of 10 Hz. Its peak power is 6 megawatts or higher, and its angle of divergence is 1 milli arcdegree; the ranging capability is 150-15,000 meters with an accuracy of less than 10 meters. The range of pointing angles of the laser beam is between 0 and 12 degrees, and its synchronization accuracy is 2 milli arcdegrees. The unit has been designed to operate over a temperature range of -45°C to 60°C.

#### Ground Test and Flight Test Results

In accordance with the requirements of the product "Technical Conditions" manual, various ground tests and flight tests of the rangefinder were conducted by user organizations, military representatives, and quality assurance organizations. First, routine tests which included the technical performance evaluation test, high temperature and low temperature tests, shock tests, vibration tests, and electromagnetic disturbance tests were conducted; then, in compliance with the "Guidelines for Design Certification Ground Test" approved by the Aviation Product Certification Committee, 8 cycles of verification tests were conducted, each containing 64 separate tests. During these tests, the unit operated under power for 150 hours under a wide range of environmental conditions, and almost 60,000 target rangings (actual and simulated) were made. The test results show that the basic principle of the rangefinder is sound, and the designs for the control, interface, and logic relationships were correct; furthermore, the measured technical performance induces all satisfy the requirements as specified in the "Technical Conditions" manual.

Prior to the flight test, the unit participated in a ground systems test by connecting it to the onboard equipment and also in a powered acceptance test onboard the aircraft. These tests were designed to evaluate the stability of operation and ranging accuracy of the rangefinder as well as the electromagnetic tolerance of the onboard radar, the radio station, the computer, the aiming device and other electrical equipment. The test results show that the rangefinder is stable, and the electromagnetic tolerance satisfies the HB 5662-81 requirement; the maximum ranging error is 6 m.

The flight tests for design certification took place between July 1986 and March 1987 on an Air Force attack aircraft. A total of 26 flights were flown and the total operating time was approximately 14 hours. During these tests, rangings of different targets were made under a variety of flight conditions in order to measure such technical performance parameters as synchronization accuracy, ranging capability, etc., and to evaluate the system's bombing and targetting accuracy by connecting

the unit to the fire control system. The flight test results show that the performance of the laser rangefinder is satisfactory, and the measured tactical and technical parameters either meet or exceed design requirements. For example, with the laser rangefinder, bombing accuracy is greatly improved: based on the statistics of nearly 100 target points, the average longitudinal and lateral deviations were 2/3-3/4 of the design value. This illustrates that the synchronous laser rangefinder effectively improves the combat performance of the attack aircraft, particularly in terms of attacking targets located on a mountain. For this reason, this product is expected to be widely used on future fire control systems.

#### Main Features

The main features of the synchronous laser rangefinder are as follows:

1. Ranging Capability. The rangefinder uses a small, high-efficiency solid pulse laser, whose photo-electric conversion efficiency exceeds 1 percent at an input energy level of more than 10 joules. It also uses low-voltage silicon avalanche receivers which greatly enhance the system sensitivity. Under a visibility condition of scale 7, the maximum measured range for a target with a diffuse reflectivity of 0.2-0.3 is 15.6 km.
2. Ranging Accuracy and Synchronization Accuracy. The range data processor uses a high-precision timing unit and a high-precision digital-to-analog converter as well as a tight logic control unit; the ranging accuracy is 5 m with digital output and 10 m with analog output. The servo amplifier uses a 2nd-order composite-error control loop which provides good dynamic characteristics and high synchronization accuracy.
3. Electromagnetic Tolerance. The rangefinder uses a L-C constant-current charging circuit as the power source for the laser transmitter. With appropriate measures to guard against electromagnetic disturbances, disturbances due to propagation and radiation effects are greatly reduced. Test results show that all the indices of electromagnetic tolerance satisfy the requirements for airborne equipment.
4. Reliability and Maintainability. In the design of the rangefinder, reliability analysis was performed and effective reliability measures were implemented in the prototype design. For example, key components with rather high failure rates (e.g., the xenon lamp, the controllable silicon, etc.) were designed using the reduced-rating design criteria; also, a laser with externally replaceable lamp and modularized boards were used in order to reduce the time for lamp replacement and for trouble-shooting and maintenance. In addition, proper thermal design has been implemented to ensure operating stability of the laser and electronic circuits. Therefore, the MTBF of the rangefinder satisfies the requirement of the cross-linked system.

3012/12223



Silicate Institute Develops High-Tech BGO Crystals

40080149a Shanghai JIFANG RIBAO in Chinese 25 May 88 p 1

[Article by Jia Baoliang [6328 1405 5328]: "BGO Crystals Beat Competitors From Japan and the United States"]

[Text] In the intense competition in the international market, Chinese-made BGO crystals beat competitors from Japan and the United States and created more than \$8 million in foreign exchange. According to the responsible department in the Shanghai branch of the Chinese Academy of Sciences, such crystals have become the most competitive high-tech product from the Chinese Academy of Sciences and have created the largest amount of foreign exchange.

The BGO crystal was developed by the Shanghai Silicate Institute of the Chinese Academy of Sciences. It can be broadly used in high energy physics, space physics, nuclear physics, geological survey, and radiological therapy. To meet the demands of the international market, European countries, the United States and Japan have all competed in the development of BGO crystals in recent years. The Shanghai Silicate Institute mobilized its resources in a timely manner and organized a team to attack the problem. Within a short period of one year or so, the first batch of crystals were produced. Tests performed by international experts showed that the quality and dimension of these crystals met the standards of first rate products. Subsequently, in bids in which American and Japanese firms participated, the Chinese products won and were selected by the Western Europe Nuclear Research Center (CERN). Since 1985 CERN has contracted the Shanghai Silicate Institute to provide 7,840 BGO crystal rods within 3 years at a total weight of 8.4 tons. The Shanghai Silicate Institute has now fulfilled its contract obligations 4 months ahead of schedule. Such crystal material has become the heart of the high energy detectors used by the group led by Samuel C.C. Ting at CERN.

The success of the BGO crystals on the international market has opened an avenue for technology intensive scientific products produced by the Shanghai Silicate Institute. This high-tech item has now established connections with a dozen vendors in the United States and Europe. The foreign companies are saying that "If you need BGO crystals you have to go to the Chinese!" It was reported that the BGO crystals have attracted a great deal of attention by winning the first (Yi-li-da) Science and Technology Award and a gold medal from the fifteenth international new technology exhibit.



Update on Progress of Position-Electron Collider Technology

40080149c Beijing RENMIN RIBAO in Chinese 16 Jun 88 p 3

[Article by Wu Fumin [0702 1788 3046]: "Plastic Shaped Part for Streamer Tube Successfully Developed"]

[Text] A comb-shaped plastic part for streamer tubes, the newest high-tech scientific research product developed in China, has passed qualification at the High Energy Physics Research Institute of the Chinese Academy of Sciences.

It was determined by plastics experts from the Chinese Academy of Sciences and from the plastics industries in China that the product has met the manufacture specification of the muon detector of the world's largest position-electron collider under construction at CERN in Geneva. This achievement indicates that China's plastics allotype technology has entered the international scientific research arena and has reached world standard.

This plastic product, developed by the Shanghai Institute of Plastics Products, has great potential for entering the international market of scientific research products. The Shanghai Institute was commissioned by the "A-lai-fu" international cooperation group of the High Energy Physics Research Institute, Chinese Academy of Sciences, 2 years ago to develop this product. After as many as 100 trials and a large amount of work in tool design, material formulation, and fabrication flow chart engineering, the product was finally developed in May 1988. The product is now mass produced by the Shanghai Kailong Plastics Plant. The product quality rivals other similar products on the international market, which made China the second country after Italy to produce this item. This shaped plastics has a wall thickness of only 1 mm and an accuracy of 0.1 mm. The 8 meter long tube must be straight and have a clean inner surface. The Chinese plastics industry had to deal with unprecedented manufacturing specifications. The successful development of this item shows that China has made great strides in plastic extrusion technology in the past 2 years and ranks among the leading countries in the world.

9698/08309

STATIC CHARACTERISTICS OF CIRCULAR SYMMETRIC ANNULAR JOSEPHSON JUNCTION. I.  
QUASI-DIFFRACTION CHARACTERISTIC, SELF-FIELD EFFECTS

40090111a Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 705-713

[English abstract of article by Wang Wei [3769 3555], et al., of the Department  
of Physics, Nanjing University]

[Text] The static Josephson effects in circular symmetric annular junctions are discussed in this paper. When the annular widths are smaller than  $\lambda_J$ , analytical solutions of the magnetic field dependence of the maximum Josephson current  $I_m$  are obtained. Since the external magnetic field is nonuniformly distributed in the junctions, the minima of  $I_m$  are not equal to zero. These results exhibit a quasi-diffraction characteristic. When the annular widths are larger than  $\lambda_J$ , the numerical solutions of the self-field equations are obtained which show the magnetic field dependence of the maximum Josephson current  $I_m$  and the current distribution. Due to the two-dimensional characteristic, the maximum points of  $I_m$  are not on the axis where the external field is equal to zero in the plot  $I_m$  vs  $I_H$ .

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STATIC CHARACTERISTICS OF CIRCULAR SYMMETRIC ANNULAR JOSEPHSON JUNCTION. II.  
STABILITY OF SOLUTIONS OF SELF-FIELD EQUATIONS

40090111b Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 714-719

[English abstract of article by Wang Wei [3769 3555], et al., of the Department  
of Physics, Nanjing University]

[Text] The stability of the solutions of the self-field equations for circular  
symmetric annular Josephson junctions is analyzed in this paper. The stability  
of the solutions is determined by the signs of the second-order variation of  
the free energy with respect to the variation of the phase difference in the  
junctions. This criterion can then be transformed to an eigenvalue problem.  
The solutions may be stable, nonstable or metastable for a given bias current.

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EXCITATION OF ELECTRON PLASMA WAVES BY BEATING TWO SELF-TRAPPED LASER BEAMS

40090111c Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 735-742

[English abstract of article by Ma Jinxiu [7456 6930 4423], et al., of  
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper presents and analyzes the focusing of pump beams and the excited EPW (electron plasma wave) in a PBWA (plasma-beat-wave accelerator) by beating two self-trapped laser beams. The equations governing the saturated amplitudes of EPW in nonuniform pump beams have been derived analytically. With these, the self-trapping condition of pump beams has been studied self-consistently. The optimum frequency mismatch parameter and the corresponding optimum initial plasma density, as well as the maximum amplitude of the EPW, have been obtained analytically. The transverse distribution of the EPW for Gaussian pump profiles has been calculated numerically and shows peculiar characteristics for certain frequency mismatch parameters. In addition, the component of the EPW electric field due to the nonuniformity of the pump beams has been obtained and its influence on particle acceleration in PBWA is discussed briefly.

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NONLINEAR THEORY OF PHOTOACOUSTIC EFFECT OF RESTRICTED BEAM

40090111d Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 769-775

[English abstract of article by Du Gonghuan [2629 0501 3562] of the Institute  
of Acoustics, Nanjing University]

[Text] When a chopped light impinges on a solid sample in a photoacoustic cell, an acoustic signal is produced, not only with the fundamental but also with the second harmonic component, due to the nonlinear photoacoustic effect. An equation for the nonlinear thermal wave beam is presented with nonlinear boundary conditions and is solved using the perturbation approach method when the light source has a Gaussian profile. The Hankel transformation is utilized to attain the first and second order approximation solutions of the equation.

The analytical results show that the thermal wave beam of the second harmonic maintains the Gaussian profile with a smaller Gaussian radius than that of the fundamental component, and also that the amplitude of the second harmonic relates not only to the linear but also the nonlinear thermal parameters, which might be expected to extract more information from the sample than would the linear one. Based on these results, a new nonlinear photoacoustic technique is expected to be developed.

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ELECTRICAL PROPERTIES OF CRYSTALLINE-NONCRYSTALLINE COMPOSITE Li IONIC CONDUCTOR

40090111e Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 782-788

[English abstract of article by Nan Cewen [0589 4595 2429], et al., of the  
Department of Silicate Materials Science and Engineering, Wuhan University of  
Technology]

[Text] In the paper, the electrical properties of a crystalline LiCl-  
noncrystalline  $\text{Li}_2\text{O} \cdot 3\text{B}_2\text{O}_3$  composite Li ionic conductor are studied. Some new  
phenomena of changes in electrical properties of this composite ionic conductor  
have been found, i.e., a "two-peak" effect of conductivity enhancement appears  
on macroscopic conductivity  $\sigma_m$  versus the composition curve. Correspondingly,  
"two-valley" appears on apparent activation energy  $E_m$  versus the composition  
and dielectric constant  $\epsilon_m$  versus the composition curve. These experimental  
phenomena have been discussed in detail, and the results are consistent with  
the conduction theory.

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PHOTOVOLTAIC DETECTION OF MAGNETIC RESONANCE IN a-Si:H SOLAR CELL

40090111f Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 5,  
May 88 pp 847-850

[English abstract of article by Yan Maoxun [2518 2021 3169], et al., of the  
Department of Physics, Beijing University; Lin Xuanying [2651 2467 5391],  
et al., of the Department of Radio-Electronics, Beijing University]

[Text] An investigation of spin dependent recombination processes in p<sup>+</sup>i n<sup>+</sup>  
a-Si:H solar cells by photovoltaic detection of magnetic resonance (PDMR) is  
reported. The study indicates that the PDMR signals for various solar cells  
made by different technologies have different g-values and line shapes, so  
the dominant recombination processes are different. The influence of the  
speed of growth, substrate temperature and intrinsic thickness of a-Si:H film  
on solar cell properties is discussed in terms of the PDMR results.

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STUDY OF SHEEP TISSUE CONTAMINATION OF  $^{131}\text{I}$  AFTER ACCIDENT AT CHERNOBYL

40090112a Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 11 No 6,  
Jun 88 pp 26-30

[English abstract of article by Ku Deredi [1655 1795 3583 2251], et al., of  
Xinjiang Institute of Radiation Medicine and Protection, Urumqi]

[Text] The change in  $^{131}\text{I}$  content in sheep tissue in Xinjiang following the accident at Chernobyl, USSR, was studied using a radiochemical method. The results showed that the  $^{131}\text{I}$  level increased in sheep tissue on 7 May, reaching its maximum on 20 May in the thyroid. The effective half-life of  $^{131}\text{I}$  in thyroid, blood, muscle and stomach contents was 7.2d, 6.7d, 6.7d and 5.1d, respectively. The specific activities of  $^{131}\text{I}$  in grass, thyroid, blood, muscle and stomach contents showed linear correlations. The  $^{131}\text{I}$  content in the thyroids of folded sheep was only 1.7 percent that of grazing sheep during the polluting period. The effective dose equivalents for adults to the  $^{131}\text{I}$  release from Chernobyl were 14.0  $\mu\text{Sv}$  in Urumqi and 3.8  $\mu\text{Sv}$  in Xinjiang.

 $^{131}\text{I}$  Pollution Level in Sheep Thyroid from 7 May to 2 August

No	Sampling Site	Integrated Specific Activity
1	Urumqi	$1.47 \times 10^4$
2	Altay	$8.90 \times 10^3$
3	Tacheng	$6.60 \times 10^3$
4	Yining	$7.13 \times 10^3$
5	Kuitun	$6.81 \times 10^3$
6	Hami	$1.57 \times 10^3$
7	Kuerlei	$5.93 \times 10^2$
8	Akesu	$1.99 \times 10^2$
9	Kashi	$4.42 \times 10^2$
10	Hetian	$4.18 \times 10^2$

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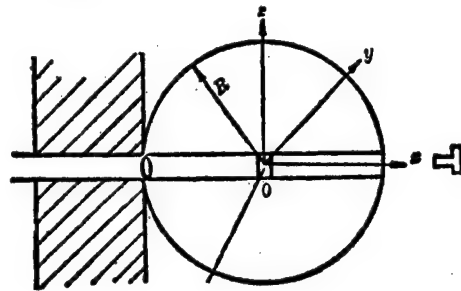


CALCULATION OF GAMMA-RAY DETECTION EFFICIENCY OF LARGE LIQUID SCINTILLATION COUNTER FOR  $(n,\gamma)$  RADIATIVE CAPTURE

40090112b Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 11 No 6,  
Jun 88 pp 34-38

[English abstract of article by Wang Shiming [3769 0013 2494], et al., of the  
Institute of Nuclear Science and Technology, Sichuan University]

[Text] With the Monte Carlo method, the gamma-ray detection efficiency of a large liquid scintillation counter and the correction for neutron multiple scattering in the sample have been calculated. Some results and discussion are given.



Schematic Diagram of Experimental Equipment

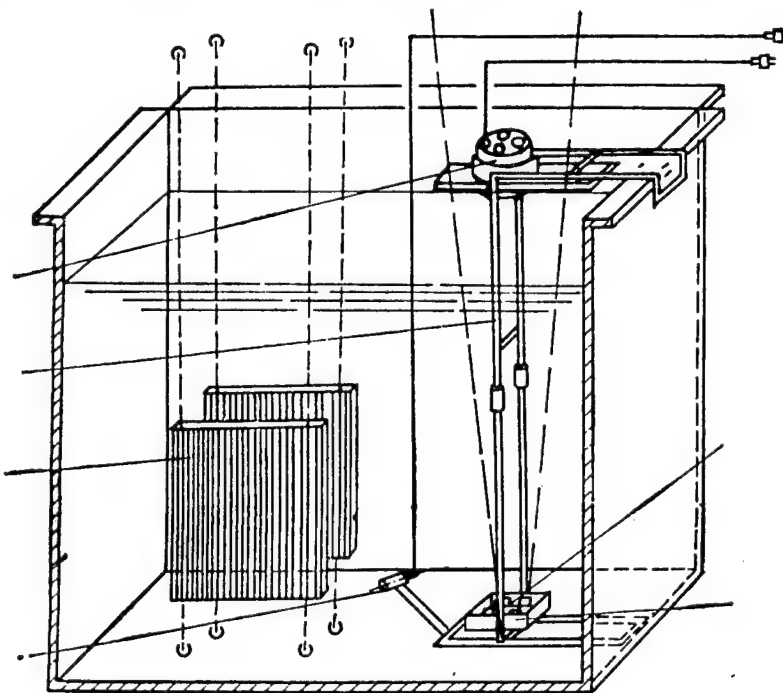
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# ACTIVITY MEASUREMENT OF HIGH INTENSITY $^{60}\text{Co}$ ELEMENTS

40090112c Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese Vol 11 No 6, Jun 88 pp 52-55

[English abstract of article by Hou Hailin [0186 3189 2651], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] The procedure for measuring the activity of intense  $^{60}\text{Co}$  elements in the Shanghai Irradiation Base and the benefits thus brought in are described. The determination of the build-up factor B is also presented. Two methods using under-water and over-water ionization chambers respectively are compared, and the former is found to be more accurate.



Measuring Appliance of Cobalt Source Activity

An Investigation on the Surface Hardness and Electric Resistance in Cu-Ti Thin Films by Ion Beam Mixing

40090118a Shenyang DONGBEI GONG XUEYUAN XUEBAO [JOURNAL OF NORTHEAST UNIVERSITY OF TECHNOLOGY] in Chinese Vol 9 No 2, Jun 88 pp 167-172

[English abstract of article by Shi Liquan [2457 4539 5028] et al. (Vacuum & Applied Physics Sections)]

[Text] Measurements of surface hardness and electric resistance of Cu-Ti bilayer and multilayer films, implanted with 350 keV Xe<sup>+</sup> ion-beam, are presented to discuss the aging effect on them with TEM analysis. The result indicates that both the surface hardness and resistance varied after implantation, especially the remarkable increase in hardness. It is observed that after annealing at 100-400°C these variations are mainly caused by the resultant effects of the implantation before annealing, the phase transformation invoked by heat treatment and the recoverability from damage.

(Received 31 Oct 87)

/08309

Experimental Research on the Thermal Characteristics in ESR [Electroslag Refining] Process

40090118b Shenyang DONGBEI GONG XUEYUAN XUEBAO [JOURNAL OF NORTHEAST UNIVERSITY OF TECHNOLOGY] in Chinese Vol 9 No 2, Jun 88 pp 184-189

[English abstract of article by Jiang Zhouhua [1203 0719 5478] et al. (Special Metallurgy Section)]

[Text] The temperatures on the electrode surface in a slag pool and on the bottom of the ingot in the ESR process are all measured, as well as the temperature distributions on a mold wall and in cooling water along the height. With the heat flux meter mounted on the mold wall, the heat flux density distribution along the height of the inner side of the mold wall is also measured, thus examining the effects of three slag systems on the thermal behavior of the ESR system.

(Received 19 Feb 87)

/08309

A 32-Channel Microcomputer System for Temperature Measurement in Furnace  
ESR [Electroslag Refining]

40090118c Shenyang DONGBEI GONG XUEYUAN XUEBAO [JOURNAL OF NORTHEAST UNIVERSITY  
OF TECHNOLOGY] in Chinese Vol 9 No 2, Jun 88 pp 235-239

[English abstract of article by Zhang Ying [1728 4481] et al. (Special  
Metallurgy Section)]

[Text] A 32-channel microcomputer system for temperature measurement in an ESR furnace was developed. There are 32 sensors distributed on the mold wall and in cooling water along the height. Its hardware system is mainly composed of thermocouples, a preceded filter amplifier circuit, a 32-channel A/D converter of 12 bits, a computer and a printer. To avoid the interference due to the surrounding strong electromagnetic field, proper measures are taken. The program is written in Z-80 assembly language, using two interrupts respectively for clocking and circular sampling by means of CTC. It has been proved easy to control, reliable and accurate within 2-5 percent.

(Received 20 Feb 87)

/08309

Briefs

Neutron Flux Measurement Device--A neutron flux monitor and measurement device developed by the Metals Institute of the Chinese Academy of Sciences had recently passed technical qualification in Beijing. Neutron flux monitor/measure plate is an important component of the neutron flux monitor device in the pressure vessel of nuclear power stations. There are stringent requirements on the raw material and the fabrication procedures of neutron flux monitors and such devices are a patent protected item in foreign countries. The devices developed in China are aluminum alloy monitor plates including 13 different plates made of Al-Co, Al-Cu, Al-Ti, Al-Fe, and Al-Ni. The Chinese Atomic Science Research Institute has conducted simulation radiation tests and measurement analysis and found that the aluminum alloy detectors met every technical specification. They may be used in the monitoring of high energy neutron and gamma rays so that assessments may be made for any changes in the pressure vessel steel of a reactor. This can prevent pressure vessel failures and ensure safe operation of the power station. [Text] [40080149b Beijing JISHU SHICHANG BAO in Chinese 14 May 88 p 1] 9698/08309

Heavy Ion Accelerator Completed--XINHUA, Lanzhou, 13 Jul -- China's largest heavy ion facility for physics experiments, the Lanzhou Heavy Ion Cyclotron Accelerator, was recently completed and put into operation and is expected to be formally commissioned and handed over by the end of the year. This not only gives China the means to conduct heavy ion physics research but also places our cyclotron accelerator research capability right along with the advanced nations of the world. This heavy ion accelerator has the highest energy, the greatest diversity of particles, and is the largest of any such facility in China and is located at the Modern Physics Institute of the Chinese Academy of Sciences. It is one of three such facilities in the world today of comparable size. One of three major nuclear physics projects, the Lanzhou heavy ion accelerator will be China's State Laboratory. [Text] [40080174a Beijing RENMIN RIBAO in Chinese 14 Jul 88 p 3]

High-Efficiency Silicon Solar Cells--A new processing method for simultaneous deposit of the  $\text{Si}_3\text{N}_4$  AR (anti-reflective coating) on the solar cell via LPCVD (low-pressure chemical vapor deposition) and formation of the Al-alloy high-low junction BSF (back surface field) is described. This one-step AR-BSF formation technique simplifies the process for manufacturing high-efficiency solar cells. Because the system is in a high vacuum and the solar cells are in an atmosphere of  $\text{N}_2$  and  $\text{H}_2$ , the surface characteristics of the cell emitters are improved. Results demonstrate that, in order to achieve high solar cell performance with this technique, a thick Al film, a relatively high  $\text{Si}_3\text{N}_4$  deposition temperature, and an 80-100-angstrom-thick layer of  $\text{SiO}_2$  for the cell emitter surface are required. [Summary] [40080174b Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 10 No 3, May 88 pp 285-288]

/12223

PRELIMINARY APPROACH TO VARIATIONS OF SERUM ADANOSINE DEAMINASE LEVELS IN PATIENTS WITH EPIDEMIC HEMORRHAGIC FEVER

40091059a Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 6 No 2, May 88 pp 73-76

[English abstract of article by Jia Fuzhong [6328 6534 1813], et al., of the Department of Infectious Diseases, Nanjing Medical College]

[Text] Serum adenosine deaminase (ADA) was determined in 96 cases of epidemic hemorrhagic fever (EHF) of various degrees of severity. The ADA levels were found elevated in all patients. Early in the febrile stage of the disease, the ADA levels were two to three times that of normal levels and were sustained for 7 to 10 days. Daily comparisons between the ADA levels and the atypical lymphocytes in the peripheral blood showed that there was the tendency toward the parallel increase or decrease of ADA and the lymphocytes. When considering the atypical lymphocytes to be the active cells and ADA to be an indispensable enzyme during lymphocyte differentiation, the authors assume that both the appearance of atypical lymphocytes and the elevated ADA levels in EHF reflect the unusual differentiation and proliferation of lymphocytes resulting from the stimulation of the EHF virus.

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CLINICAL SIGNIFICANCE OF MEASUREMENT OF SERUM PREALBUMIN TRANSFERRIN,  
ALPHA<sub>1</sub>-ANTITRYPSIN IN VIRAL HEPATITIS

40091059b Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 6 No 2, May 88 pp 89-91, 99

[English abstract of article by Shang Lanming [0006 5663 2494], et al., of Shanghai Municipal Infectious Diseases Hospital]

[Text] Serum prealbumin (PA), transferrin (Tf) and  $\alpha_1$ -antitrypsin ( $\alpha_1$ -AT) were measured in 135 cases of different types of viral hepatitis and in 24 normal subjects through the Lanrell technique (rocket electrophoresis) and modified Lane technique, respectively. Among them, serum PA levels decreased (normal limit  $32.54 \pm 6.13$  mg/dl) in 45 percent of the patients, with three of them dying while their serum PA levels decreased to zero. However, their serum albumin remained in the normal range. Serum Tf levels in viral hepatitis patients were significantly lower than in the control group ( $253.87 \pm 52.21$  mg/dl) and the degree of serum Tf decrease was as follows: severe hepatitis > liver cirrhosis > chronic active hepatitis > chronic persistent hepatitis > acute hepatitis. The changes in serum  $\alpha_1$ -AT in viral hepatitis showed no significant difference except for its level increasing in acute hepatitis and decreasing in severe hepatitis. Therefore, the measurement of serum PA, Tf and  $\alpha_1$ -AT may be helpful in determining the diagnosis, treatment and prognosis of liver disease.

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OCCURRENCE OF PLASMID DNA IN CAMPYLOBACTER JEJUNI, CAMPYLOBACTER COLI,  
ANALYSIS OF RESTRICTION ENDONUCLEASE

40091059c Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS  
DISEASES] in Chinese Vol 6 No 2, May 88 pp 92-94

[English abstract of article by Sun Zijie [1327 5261 2212], et al., of the  
Department of Biochemistry, Children's Hospital, Shanghai Medical University]

[Text] Thirty-two strains of different serotypes and biotypes of *Campylobacter jejuni* and *Campylobacter coli* isolated from the stool of children and domestic animals were examined for the presence of plasmid DNA. Agarose gel electrophoresis of alkaline-extracted DNA showed the occurrence of plasmid bands in 12 strains. Of these, 10 showed only one plasmid band in the >23 Kb area of the gel, and 7 strains containing this plasmid were further analyzed by restriction endonuclease Hind III. All restriction fragments showed heterogeneity. Two of the twelve strains from domestic animals were observed, with three and four plasmid bands being demonstrated in agarose gel, respectively. The incidence of plasmid in *Campylobacter jejuni* strains was similar to that of *Campylobacter coli*, while the incidence of plasmid in *Campylobacter* strains from the stool of domestic animals was higher than that in children.

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STUDY OF SURVEILLANCE OF HOUSE RAT-TYPE EPIDEMIC HEMORRHAGIC FEVER

40091060a Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese Vol 9 No 3, Jun 88 pp 141-144

[English abstract of article by Su Tao [5685 3447], et al., of the Institute of Virology, Chinese Academy of Preventive Medicine, Beijing]

[Text] Epidemic hemorrhagic fever virus (EHFV) antibodies were tested in 274 randomly selected healthy individuals in Xinan County in 1984. The EHFV antibody prevalence rate was 11.3 percent in March and 16.4 percent in July. No symptoms could be found in the seroconverted cases. However, a dynamic change in EHFV infection was found among the *R. norvegicus* population according to the monthly data of EHFV carrying rates, EHFV antibody prevalence rate, GMT and changes in their composition fraction in the same area. The seasonal increase in EHFV infection among *R. norvegicus* may be caused by the broad and close contact during their active mating and breeding in the spring. This apparently provided the basis for the epidemic of the rat-type EHF in humans. Some rabbits and pigs in the Xinan County vicinity were found to be infected with EHFV, and the antibody prevalence rate was 5.65 and 6.13 percent, respectively. The EHFV antigen was found in the spleens of two rabbits.

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APPLICATION OF JAPANESE B ENCEPHALITIS McAb FOR REVERSE PASSIVE HEMAGGLUTINATION TEST IN SERO-DIAGNOSIS OF JE

40091060b Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese Vol 9 No 3, Jun 88 pp 148-149

[English abstract of article by Zhao Guoguang [6392 0948 0342], et al., of the Sanitary and Anti-epidemic Station, Zhengzhou City]

[Text] An application of Japanese B encephalitis (JE) McAb for the RPHI test, and its comparison with the HI test, for the detection of JE antibodies in 60 serum samples of acute stage JE patients is reported. The results show that the positive rate of RPHI was 85.0 percent (51/60), while that of HI was 53.3 percent (32/60). No significant differences were found between these two methods. The RPHI was sensitive, specific, rapid and simple to perform. Therefore, this technique is suitable for laboratory diagnosis and the serum-epidemiological study of JE in peripheral hospitals and anti-epidemic stations.

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MULTIVARIATE ANALYSIS OF RISK FACTORS AFFECTING INFECTIVITY OF HBV SEROLOGICAL MARKER CARRIERS IN FAMILY

40091060c Beijing ZHONGHUA LIUXINGBINGXUE ZAZHI [CHINESE JOURNAL OF EPIDEMIOLOGY] in Chinese Vol 9 No 3, Jun 88 pp 154-157

[English abstract of article by Liu Tiefu [0491 6993 3940], et al., of the Department of Epidemiology, Tongji Medical University, Wuhan]

[Text] Familial HBV transmission is influenced by many factors. The effects of different HBV serological markers and other risk factors on familial HBV transmission can be quantified by multivariate analysis.

It has been found that the existence of HBsAg carriers is positively associated with later acquisition of HBsAg and HBeAg among susceptible contacts within the family. The existence of anti-HBc carriers in families has been positively correlated with anti-HBc acquisition of susceptible contacts, with OR = 5.98, however, it has no relationship with their anti-HBc titer variation. The existence of anti-HBc carriers and HBsAg-anti-HBc combined carriers has been negatively correlated with serum conversion to HBsAg and HBeAg of susceptible contacts.

Age was negatively associated with HBsAg conversion, as was educational level with anti-HBs conversion. Operations and injections were positively associated with HBV serological marker conversion. Multivariate analysis has been helpful in evaluating the dynamic variation of HBV serological marker carriers in the population.

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Visual Design of Query Language for Image Database System

40090117a Hefei ZHONGGUO KEXUE JISHU DAXUE XUEBAO [JOURNAL OF CHINA UNIVERSITY OF SCIENCE & TECHNOLOGY] in Chinese Vol 18 No 2, Spring 1988 pp 217-224

[English abstract of article by Chen Tao [7115 3447] et al. (Department of Radio Electronics)]

[Text] A visual query language QPF and its implementation in a knowledge-based pictorial database system GBASE are presented. GBASE employs an extended relational database schema allowing abstract data types. Icons, as the vocabulary of QPF, are visual symbols of image entities and abstract concepts. Icons are organized in a hierarchical structure, so that users can visually retrieve both symbolic and graphical data, and browse through the entire database without prior knowledge of the contents and organization of GBASE. Therefore QPF provides users with a very friendly interaction environment.

(Received 28 Aug 87.)

Key words: information system, database, digital image processing, query languages.

/08309

## An Optimal Parallel Selection Algorithm

40090117b Hefei ZHONGGUO KEXUE JISHU DAXUE XUEBAO [JOURNAL OF CHINA UNIVERSITY OF SCIENCE & TECHNOLOGY] in Chinese Vol 18 No 2, Spring 1988 pp 232-240

[English abstract of article by Shen Hong [3088 7703] and Chen Guoliang [7115 0948 5328] (Department of Computer Science and Technology)]

[Text] The optimal parallel algorithms are those of which the product of time and the number of processors required equals the time lower bound of the corresponding sequential algorithm. To solve the problem of selecting the  $m^{\text{th}}$  or  $m$  smallest (or largest) from  $n$  given numbers, an optimal parallel selection algorithm with  $p=n^{1-\epsilon}$  processors and  $O(n^\epsilon)$  time complexity, where  $0 < \epsilon < 1$ , is presented in this paper. The proposed parallel algorithm is based on recursive filtering principle and implemented on a SIMD-SMC machine with no access conflict. (Received 18 Sep 87.)

/08309

## Briefs

Taiji 2220 Superminicomputer--The Taiji 2220 32-bit microcomputerized superminicomputer, 300-400 of which can be produced yearly by Institute 15 of the Ministry of Electronics Industry, is available in three configurations, priced at 157,000 yuan, 195,000 yuan, and 348,000 yuan, respectively. This computer is compatible with DEC's Micro VAX II, and has a 44 MB virtual memory, 16 MB real storage, and a processing speed of 0.9 MIPS. External equipment includes an 86-500-MB system disk, an 800-KB two-sided diskette, an industrial-standard tape drive, a cassette tape drive, a Chinese-English terminal, and a Chinese-English printer. The operating system uses Micro VMS V4.4, and program design languages include BASIC, C, COBOL, FORTRAN, and PASCAL. This Chinese-made product saves 75-78 percent of foreign exchange. [Summary] [40080178a Beijing DIANZI SHICHANG [ELECTRONICS MARKET] in Chinese 2 Jun 88 p 2]

Sinicized OS/2 Operating System--The Chinese Academy of Sciences' (CAS) Computing Institute Company, CAS's Beijing Software Laboratory, and Northern Jiaotong University's Computing Institute held a joint press conference in Beijing on 2 June to formally announce their introduction of two editions (for 286 and 386 systems) of a Chinese/English multitask operating system CCOS/2: CCOS/2UA1.0 and CCOS/2UB1.0. This joint effort to Sinicize [IBM's] new OS/2 operating system, carried out in less than 4 months, has produced China's first multitask operating system for handling memories of over 640K: the new CCOS/2 systems can handle main memories of 16MB and virtual memories of 1 GB. [Summary] 40080178b Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese, No 22, 8 Jun 88 p 1]

Handwritten Character Recognition System--After an effort of 2 and 1/2 years, a unit of the [PLA] General Staff's Signal Corps Department has developed an "On-line Handwritten Chinese-Character Recognition System," which underwent ministry-level technical accreditation in Beijing on 27 May. This system utilizes fuzzy descriptive grammar to capture the essential characteristics of the characters. Principal features of the system are as follows: character inputting is not limited to stroke order, character size can be large or small, and to a certain degree it can be applied to the widely used connected stroke writing. The system can recognize the basic level of 6,763 Chinese characters, including 1500 traditional characters and variant forms; average recognition



rate is 92 percent with a response time of less than 0.4 seconds per character. Average inputting speed is 18 characters per minute. In its phrase recognition mode, the recognition rate is improved, and average inputting time is speeded up by 200 percent. The system is designed for IBM-PC/XT/AT/286 microcomputers and the Great Wall 0520-A/B/CH/286 microcomputers. [Summary] [40080178c Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 8 Jun 88 p 1]

Software Development Agreement With U.S.--The Software Center of the State Science & Technology Commission recently signed an agreement with the U.S. company CPRC for long-term cooperation in the international computer software market. According to the spirit of the agreement, both sides will cooperate over a long period in technology, personnel, and marketing to promote development of China's software export industry. CPRC will be responsible for providing software technology; the Computing Center will assume responsibility for the organization within China of relevant units to carry on the projects. [Text] [40080178d Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 8 Jun 88 p 1]

Distributed Real-Time Multitask Operating System--Jiangsu Province Computing Technology Institute has developed DMOS, a distributed real-time multitask operating system for thw IBM-PC/XT and similar compatible computers. This system is compatible with PC DOS 3.1. DMOS supports multiwindow man-machine interfacing, and its communications software permits high-efficiency direct communications with and remote control of various machine processes. The distributed processing functions are especially applicable to embedded distributed systems. DMOS's network control and communications subsystems can provide electronic mail, peripheral equipment sharing, and downloading functions. This system is especially suited to information management, industrial control, and simulation systems. All software (including kernel, communications, file system, window management, and other modules) is organized in C language and assembly language. The system is easy to expand, maintain, and transplant. [Summary] [40080178e Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 23, 15 Jun 88 p 1]

LSI/VLSI Analysis System--HICAS, a "32-bit supermicrocomputer LSI/VLSI analysis system with automatic graphical montage functions" recently perfected by Harbin University, is China's first independently developed IC chip analysis system with high-precision, high-speed image and graphics processing functions for a 32-bit supermicrocomputer (the Micro VAX II is used as the host computer). Features include image processing and correction, graphical editing, image and graphics montage, an integrated automatic/interactive pattern extraction, pattern verification, and various data interfaces. It is intended for precise extraction of pattern data for LSI chips with a characteristic size of 2-3 microns. After verification, the pattern data can be directly put into a PG tape for mask making, or can be passed on to CV, MCV, and other machines. The process is easily adaptable to CAD systems for

pattern verification, processing, and redesign. The system can also extract units or structural modules of VLSI chips with a characteristic size of 1-2 microns. The manufacturing unit, which has already employed the system for the C4517C MOS LSI-chip mask-making project of Plant 691, is currently cooperating with Institute 771 in developing circuit copies of the 80C86 CPU, the largest project of its kind in the Seventh 5-Year Plan. Specialists at the recent accreditation at Harbin University agreed that this system will greatly improve the design and pace of development of LSI and VLSI components in China. [Summary] [40080178f Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 24, 22 Jun 88 p 2]

/12223

Design, Implementation of Expert Intelligent Controller for Fiberoptic Drawing Process

40080116 Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese  
Vol 17 No 1, Feb 88 pp 36-39

[Article by Zhu Zhixiang [2612 1807 4382], Dai Guangzhong [2071 0385 0022], and Yu Tiejun [0827 6993 6511] of the Northwest Polytechnic University Computer Department, Xi'an: "Design and Implementation of an Expert Intelligent Controller"--manuscript received 18 May 1987]

[Text] Abstract

This article describes a real-time expert intelligent controller [EIC] for tension control during the optical fiber drawing process. This controller was implemented on an IBM-PC microcomputer. The excellent operational results of the closed-loop tension control system indicated that the EIC we designed completely satisfied the requirement for a tension control system.

I. Introduction

The last 10 years were a decade in which self-adaptive control theory developed rapidly and entered a wide range of engineering applications<sup>1</sup>. When examining the present situation, however, one notes that the complexity of the topic itself has created a certain distance between theoretical research on adaptive control and actual applications. This is particularly true of controlling complex time-varying, non-linear, variable structure, multilayer, and multifactoral systems for which adaptive control remains ineffective. To improve the quality of control and increase economic results, it is extremely important that intensive development of theoretical research on adaptive control theory be combined with exploration of intelligent high-level expert controllers. Some have predicted that the next 10 years in control theory development will be a decade of research and development of expert control<sup>1</sup>. This developmental direction already has attracted attention<sup>2</sup>. The development of artificial intelligence and microprocessor technologies has provided theoretical guidance and implementation means for research on expert intelligent control.

Usually, one must understand a mathematical model of the control target during control system design. However, it is rather difficult to obtain a sufficiently precise mathematical model for some production processes

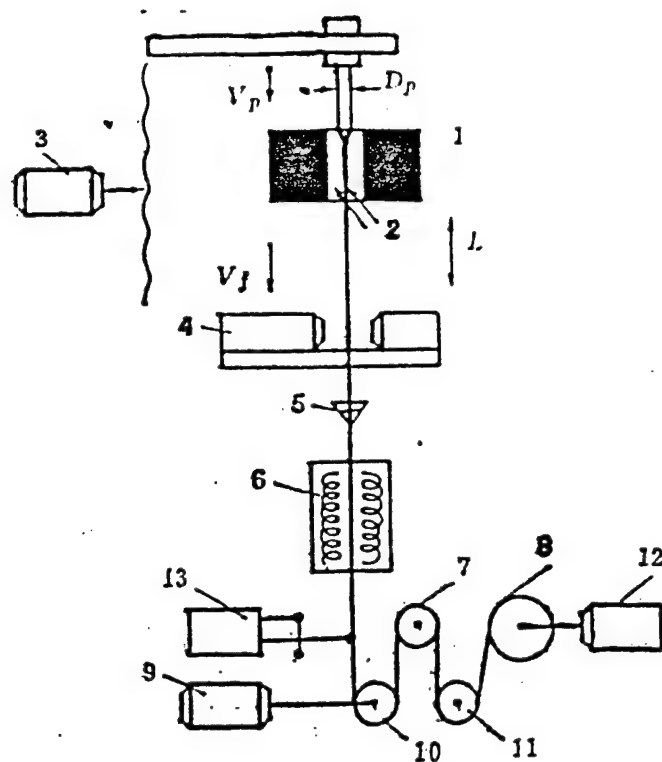
suitable for system analysis and design. Still, an operator skilled in the process can respond to and diagnose all physical quantities in a system like temperature, pressure, color, odor, and so on, and eventually achieve excellent artificial control results. This is made possible by man's intelligence and mastery. This form of control does not rely on mathematical models but instead depends only on man's accumulated experience, senses, and logical diagnosis. This can inspire us to integrate artificial intelligence and control theory to provide some intelligence to control and thereby remove control system design from total dependence on mathematical models of the control target. The growth of artificial intelligence and its permeation of the control realm has opened a new developmental direction for control theory in theory and practice and provided a new system design method, the artificial intelligence method. This method is unlike modern control theory which must rely on precise mathematical models (not excluding the use of mathematical models and precise, strict mathematical methods). Instead, it relies mainly on rules inspired by experience. The system working process often is similar to the human thought process in problem solving. Expert intelligent control systems can store knowledge from the same field or from different experts and raise the operational levels of computers higher than the levels of certain experts.

Many achievements have been made in research on control theory and applications over the past few decades and much knowledge and experience has been accumulated. This knowledge and experience was gained by research personnel during the process of solving a large number of real problems, so it is scattered and specific. It is hard to use mathematical methods to unify an algorithm universally adapted to a variety of processes. Today, with the continual appearance of new technologies and ideas and rapid additions to knowledge, an important task in research on expert intelligent control systems is to use existing knowledge and experience effectively and conveniently to reduce the burden on users and design control systems with superior functions.

## II. Tension Control Systems

Tension control in the optical fiber drawing process can serve as a background for discussing the design of an EIC. Figure 1 illustrates the principles of an optical fiber drawing process. It affects strength, dispersion, dissipation, and other properties of optical fibers. Computer control of tension is an important way to improve the quality of optical fibers. The mechanisms of changes in tension, however, are complex and involve many factors, and mathematical models of them are non-linear and time-varying. The tension we would prefer would be related only to oven temperature, but in reality tension is related not only to oven temperature but also to drawing speed, coating viscosity, height of the liquid surface of the coating cup, coating cup pressure, and other factors. No factor can be neglected and it is rather difficult to maintain constancy. The relationships among these factors are ambiguous, indefinite, and empirical, so it is hard to establish mathematical models for them. Moreover, for the same drawing speed, the rated tension value is not fixed but instead varies with working conditions. Existing control methods are ineffective for this type of system. As a result, the question of tension control during the drawing process remains unsolved. Tension and each of the interrelated factors are illustrated in Figure 2.

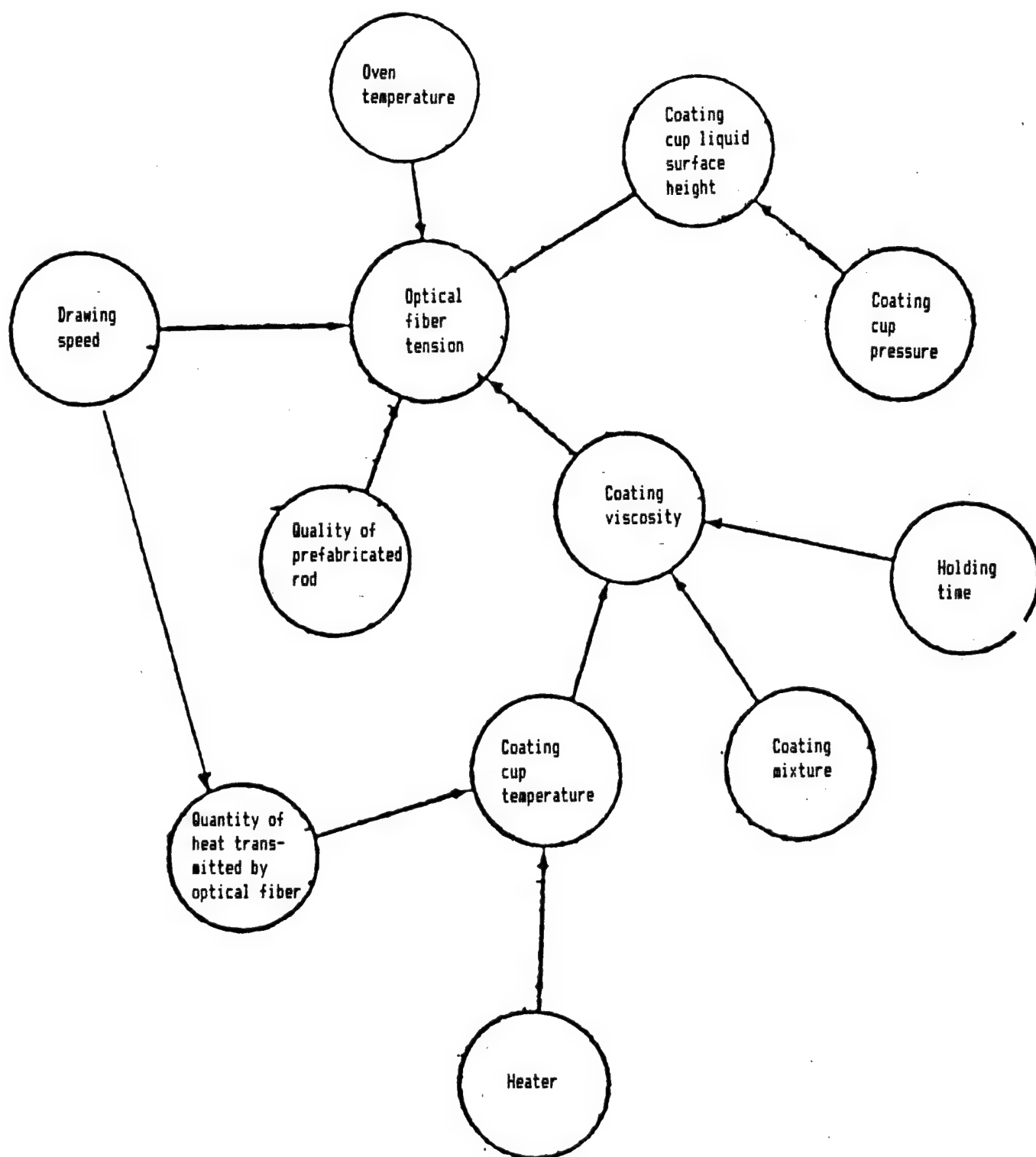
Figure 1. Principles of Optical Fiber Drawing Machine



Key:

1. High Temperature over
2. Argon gas
3. Feeder motor
4. Fiber diameter meter
5. Coating recovery cup
6. Drying oven
7. Dead pulley
8. Fiber collection spool
9. Drawing motor
10. Drawing pulley
11. Tension control pulley
12. Fiber collection motor
13. Tension detector

Figure 2. Relationship Between Tension and Interrelated Factors



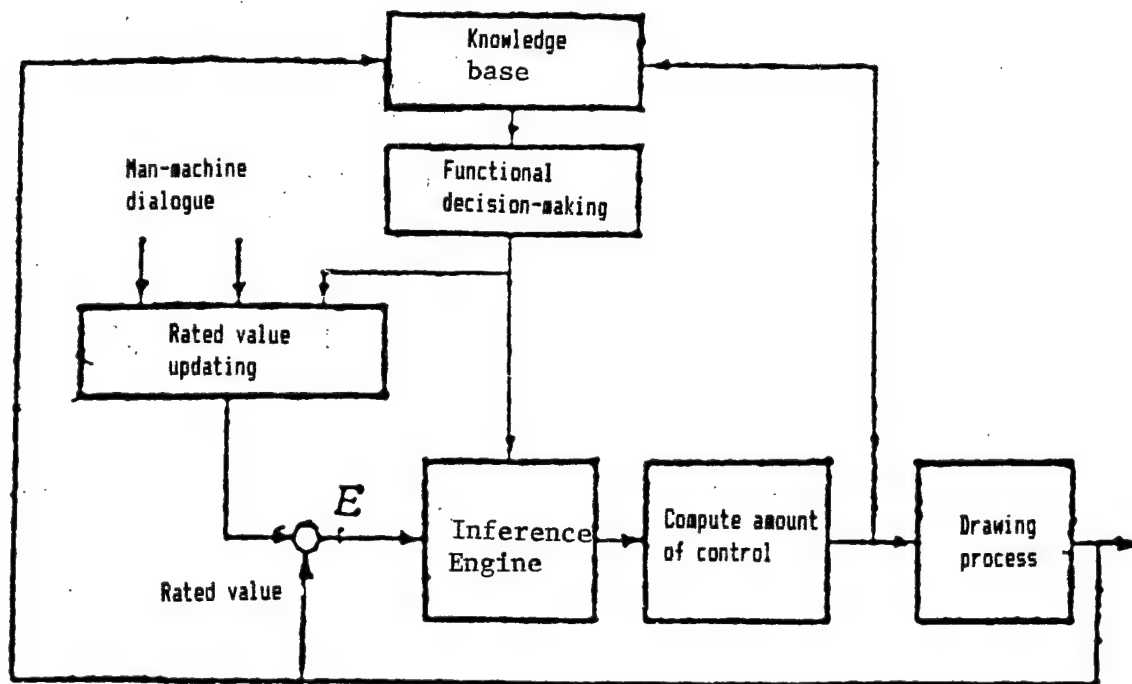
In summary, tension control during the drawing process has the following characteristics:

1. Many factors affect tension but few factors can directly control tension.
2. The control target is not fixed and rated tension values change with working conditions.
3. When the precision of control must be at a rated value of 45 to 70g, control deviation must not exceed 5g.

### III. Design of an Expert Intelligent Controller

To deal with these questions, we combined the principles and methods of artificial intelligence with control theory to process a program for expert intelligent control. This program summarized regularities in variations in tension during the drawing process into several production rules and used them as a foundation for interference of control tactics. An expert system is a computer (software) system based mainly on knowledge program design methods. It has sufficient knowledge in a particular specialized field and can use this knowledge like an expert to solve all problems in the field via interference<sup>3</sup>. Expert intelligent control systems within the controller design, and its central component is composed of a knowledge base, inference engine, and control algorithm. The knowledge base is used to store expert knowledge to solve questions in a particular field. For control questions, it consists mainly of facts, dynamic data received by sensors, and production rules. Production rules are operational rules summarized by experts on the basis of actual operating experience and are an aggregate of knowledge inference rules composed of "premises-conclusions" or "conditions-actions." This group of rules includes not only empirical regularities but also may include non-empirical regularities. The dynamic characteristics of process operation derived via the characteristic recognition method also should be stored in the knowledge base. During system operation, the inference engine works according to system state characteristics to match up with the knowledge base, select the corresponding knowledge, and implement this knowledge to change the system operation state. This selection and matching sometimes are not done alone. Deductions based on inference are not the same as traditional computer-aided design in that they can deal with indefinites. In other words, the inferential process has a heuristic quality. The control algorithm can be a PID controller, adaptive controller, fuzzy regulator, and so on. To provide the control system with the capacity to obtain knowledge automatically, there must be a self-study link to add to, delete from, and revise the knowledge base and to make on-line readjustment and determination of certain parameters in the control algorithm. The structure of an EIC is shown in Figure 3.

Figure 3. Expert Intelligent Control Structure



Our EIC contains three sets of production rules, including 24 production rules for tension control in the drawing process, 6 production rules for process breakdown diagnosis and breakdown handling, and 11 production rules for real-time management. These serve as the basis for inference for normal operation of the drawing machine and for computing control signals. The 24 production rules regarding tension control are:

01. If the oven temperature is high, optical fiber tension will be greater.
02. If the increase in oven temperature  $\Delta T$  is greater than the maximum permissible increase  $T_m$ , there must be no additional increase in oven temperature unless there are changes in the rated oven temperature.
03. If the drawing speed is too fast, optical fiber tension will increase.
- ....
24. There should be different rated tension values if there are different coating viscosities.

Inferences based on these production rules should apply characteristic recognition and matching technologies to determine the factors which cause



tension changes and fiber breakage, adopt the corresponding measures, and provide operational guidance and interpretations. If we assume that, under normal operating conditions, certain process states and parameters are a group of numerical values, then changes will occur in process parameters whenever the system deviates from normal working points or when breakdowns occur. Thus, sampling certain dynamic characteristics of the process from the changing conditions in on-line monitoring of process parameters can provide a foundation for inferential decisionmaking. In this way, the conclusions of the interference engine are not the only ones. In this situation, the heuristic method is extremely useful. Its principles of inference are:

1. According to the importance or urgency of the event.
2. According to the possibility that the event will occur.
3. An enumeration method based on the above two principles.

The various possible decisions should be processed first in sequence according to the importance and urgency of the event, or events with the greatest probability of occurring should be chosen for processing. Probability here is based mainly on subjective probability. The enumeration method is extremely effective in situations where the above two principles are ineffective because there are very few candidate decisions.

The inference process only provides a control variable or regulation direction, but does not provide a concrete regulation algorithm. The actual regulation of a control variable can be achieved with a fuzzy controller, PID, and other control algorithms. In this system, we used PID and a fuzzy controller to control optical fiber tension. The sampling signals were the system output tension deviation  $E$  and the rate of change in deviation  $\dot{E}$ .  $E$  and  $\dot{E}$  were arranged in several categories, with each pair of  $E$  and  $\dot{E}$  corresponding to a particular control variable. An example is evaluation of control variables for rated oven temperature values as illustrated in Figure 4.

Figure 4. Control Variable Evaluation Table

$U \backslash \begin{matrix} E \\ \dot{E} \end{matrix}$	$E$											
	$< -15$	$-12$	$-9$	$-6$	$-3$	$0$	$3$	$6$	$9$	$12$	$>15$	
$<0.0$	-6	-5	-4	-3	-2	0	2	3	4	5	6	
0.2	-6	-5	-4	-3	0	0	0	3	4	5	6	
0.4	-5	-4	-3	-2	0	0	0	2	3	4	5	
0.6	-5	-4	-2	0	0	0	0	0	2	4	5	
0.8	-4	-3	-2	0	0	0	0	0	2	3	4	
1.0	-3	-2	0	0	0	0	0	0	0	2	3	

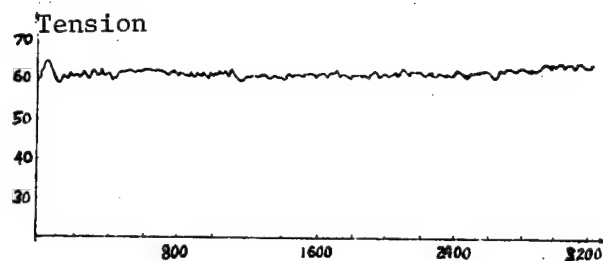
The inferential process in a EIC has the following characteristics:

1. A dynamic quality. The Nth inference is related not only to the present situation but also to the previous (N-1)th inference and control results.
2. A closed loop quality. Conditions, actions, and results form the closed loop.
3. A learning quality. Its closed loop quality strengthens the system self-study quality.

#### IV. Conclusion

We used FORTRAN77 language and 8086 assembly language in an IBM-PC microcomputer system to implement the above program. After being used for expert intelligent control, the deviation of optical fiber tension in the drawing process was less than 5g, as shown in Figure 5, which satisfied requirements. Integration of artificial intelligence methods with traditional control methods makes up for inadequacies in existing control principles and methods, and is extremely effective in solving multilevel, multifactoral, time-varying, and non-linear system control questions. Practice has proven that expert intelligent control does not require that one know a mathematical model of the control target. It can achieve control of time-varying and non-linear systems, and expert intelligent control is more adaptable to parameter variations.

Figure 5. Curve of Optical Fiber Tension Control During the Drawing Process



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NONEQUILIBRIUM PHENOMENA OF SUPERCONDUCTING TIN FILMS\*

40090119a Beijing BEIJING DAXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM  
UNIVERSITATIS PEKINENSIS] in Chinese Vol 24 No 3, May 88 pp 319-326

[English abstract of article by Luo Xiaolan [5012 1420 5695], et al., of the  
Department of Physics, Beijing University]

[Text] Some studies of the intermediate resistive states of superconductive tin films under strong quasiparticle injection by Sn-Sn superconductive tunnel junctions are reported. Three kinds of experimental conditions--large, small and intermediate critical injection voltages--exist when film voltage occurs. The theoretical analyses show that the first kind agrees better with the  $T^*$  model, the second agrees better with the  $\mu^*$  model, and the third is situated between the other two.

\*Supported by the Science Fund, Chinese Academy of Sciences.

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ON POSSIBILITY OF LASER-COOLING GASEOUS ATOMS BY USE OF LIGHT SHIFT

40090119b Beijing BEIJING DAXUE XUEBAO [ACTA SCIENTIARUM NATURALIUM UNIVERSITATIS PEKINENSIS] in Chinese Vol 24 No 3, May 88 pp 327-332

[English abstract of article by Wang Yiqiu [3769 5030 6669], et al., of the Department of Radio-electronics, Beijing University]

[Text] It is proven in this paper that the proposed method of cooling gaseous atoms using the light shift of the atomic energy level during the laser pulse is not realizable. The energy deficit of the atom in emission and absorption of a photon cannot be compensated for by the kinetic energy of the atom, but rather by the redistribution of energy between the radiation fields.

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RAMAN SCATTERING BY SURFACE PHOTON-POLARITONS

40090113a Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 5, May 88 pp 391-396

[English abstract of article by Gu Zhengang [0657 2182 0474] of the Physics Department, Xinjiang University; Cheng Yuqin [4141 5713 3830], et al., of the Department of Applied Physics, Shanghai Jiaotong University]

[Text] In this paper, the authors present a study of Raman scattering by surface polaritons (SPs). Based on the Attenuated Total Reflection method (ATR method) and Raman scattering method and referring to the Raman scattering method under ATRf conditions (RSATR) in the Kretschmann configuration, the authors suggest a method of RSATR with an Otto configuration and conduct a series of experiments on a single crystal  $\text{CaF}_2$  sample. Theoretically, the authors have obtained a phenomenological dispersion relationship of SPs on the boundary between  $\text{CaF}_2$  and air using the energy conservation law and the law of momentum conservation parallel to the sample surface, as well as a general dispersion relationship of SPs derived from a surface Green function or surface response function. With the help of the specially-designed sample carrier, the experiment has been conducted to measure the dispersion relationship of SPs. Comparison indicates that the experimental results are in good agreement with the theoretical ones.

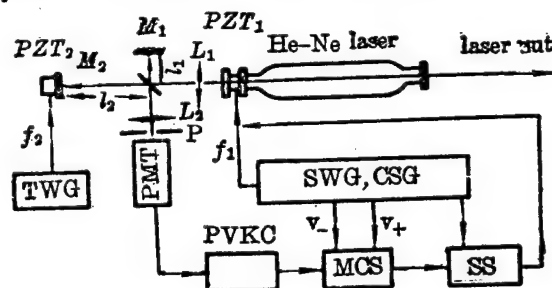
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# TC TIME-SPECTRUM METHOD FOR FREQUENCY, POWER STABILIZATION ON TWO-MODE He-Ne LASER (THEORETICAL)

40090113b Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 5, May 88 pp 397-403

[English abstract of article by Yin Jianping [0603 1696 1627] of the Laser Research Institute, Suzhou University]

[Text] Based on TC time-spectrum characteristics of a two-mode laser, this paper suggests a new method for frequency and power stabilization of the two-mode He-Ne laser--the TC time-spectrum method. The author has derived the TC time-spectrum formula, analyzed TC tuning characteristics, and introduced the experimental set-up and principle for the frequency and power stabilization of the two-mode He-Ne laser. The study indicates that the TC time-spectrum method can be used for the two-mode intracavity He-Ne laser of output random polarization characteristics and also for two-mode half-extracavity He-Ne lasers of output parallel line polarization. Then,  $\Delta\nu_D(t)$ ,  $\Delta\nu_Q(t) \ll \Delta\nu(t)$  frequency stability of  $1.6 \times 10^{-9} \sim 6.5 \times 10^{-10}$  can be achieved.



Arrangement of Frequency and Power Stabilization of Two-Mode He-Ne Laser

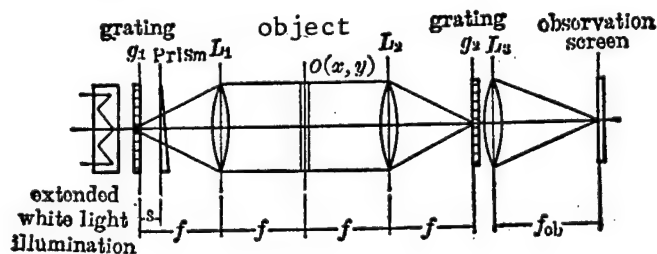
TWG: triangular wave generator; PMT: photomultiplier tube;  
PVKC: peak value keep circuit; MCS: microcomputer; SS: servo  
system; SWG, CSG: square wave and control signal generator

## REAL-TIME COLOR CODING OF DIFFERENTIAL INTERFERENCE

40090113c Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 5, May 88 pp 422-428

[English abstract of article by Liu Liren [0491 4539 0086] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A new principle is proposed to pseudocolor-code the differential interference in grating-diffraction interferometry with extended white light illumination using the dispersion effect of a prism. The phase gradients of the tested object are shown by coding colors monotonically with a determining period. The conditions required to yield such coding colors as spectral colors, mixing colors of high purity or full colors are discussed. Possible profiles of gratings are then given to obtain an exact differentiation. Some colorful interferograms are demonstrated in the experiments. Therefore, real and effective color coding of interferometrical fringes is realized for the first time.



Typical Arrangement of the System

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STUDY OF TRANSPARENT CONDUCTING INDIUM-DOPED ZnO FILMS PREPARED BY DC REACTIVE MAGNETRON SPUTTERING

40090113d Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 5, May 88 pp 448-453

[English abstract of article by Ye Zhizhen [0673 1807 6966], et al., of the Department of Optical Engineering, Zhejiang University, Hangzhou]

[Text] Transparent conducting ZnO films have been prepared by DC reactive magnetron sputtering through a modified S-gun incorporating a Zn target inlaid with indium in proportion on its surface. Films with a resistivity of  $1.08 \times 10^{-3} \Omega\text{cm}$  and transmittance of around 80 percent in the visible region have been obtained. The conductive mechanism of indium-doped ZnO films is explained on the semiconductor physics theory. Optical properties have been modeled by the Drude theory of free electrons from the visible region to the infrared region. The results show that the calculated values for the optical properties agree well with the experimental data.

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LOW-ENERGY ION-ASSISTED DEPOSITION OF  $Ta_2O_5$  FILMS

40090113e Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 5,  
May 88 pp 454-459

[English abstract of article by Zhou Jiulin [0719 0046 2651], et al., of  
Southwest Technical Physics Institute, Chengdu]

[Text] A series of  $Ta_2O_5$  films has been made by low-energy oxygen-ion assisted deposition. The microstructures of the films have been observed and the optical absorptance and scattering have been measured. Experiments show that transparent and homogeneous  $Ta_2O_5$  films can be obtained only if ion bombardment and heating of the substrate are performed simultaneously during deposition.

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ANALYSIS OF RING CAVITY OPTICALLY BISTABLE SYSTEMS WITH TWO PARTIALLY REFLECTING MIRRORS OF UNEQUAL TRANSMISSIVITY

40090116a Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH]  
in Chinese Vol 7A No 3, Jun 88 pp 161-170

[English abstract of article by Luo Liguu [5012 0448 0948] of the Department of Optics, Shandong University; Chen Jishu [7115 4949 6615] of the Department of Physics, Ningbo University]

[Text] General ring cavity optically bistable systems with two partially reflecting mirrors of unequal transmissivity are analyzed. In the mean field approximation, the steady state equation is given and the linear stability analysis of the steady states is performed. It is found that when the ratio of transmissivity  $T_1/T_2$  varies, the bistable loop changes its size and even the systematic behavior varies from the bistability mode to the amplification mode.

It is pointed out that, in the mean field approximation, there are many systems with  $\bar{K} \equiv CT_1/L_v \gg 1$  and also many systems with  $\bar{K} \ll 1$ . Self-pulsing instability is observed in the latter systems.

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STUDY OF TRANSIENT CAPACITANCE IN HETEROJUNCTION

40090116b Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH]  
in Chinese Vol 7A No 3, Jun 88 pp 185-194

[English abstract of article by Yang Wenku [2799 2429 1655] of Changchun  
College of Optics and Fine Mechanics; Deng Wenrong [6772 2429 2837] of  
Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The authors' theoretical analysis of the phenomenon of transient capacitance in heterojunction CdS/CuInSe<sub>2</sub> reveals that donors are ionized by adding a reverse dc bias  $V_{dc}$  after a forward-biased electrical pulse  $V_p$  is switched off, and then some of the electrons produced by ionization are captured by traps and recombined with the ionized donors via tunneling. This recombination process and the electron drifting in the heterojunction region lead to the transient capacitance phenomenon. The theoretical results are in good agreement with the experimental ones.

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PHOTOREFLECTANCE SPECTROSCOPY OF GaAs-AlAs MULTIPLE QUANTUM WELL STRUCTURES\*

40090116c Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH]  
in Chinese Vol 7A No 3, Jun 88 pp 195-199

[English abstract of article by Tang Yinsheng [3282 1377 3932] of the Center of Fundamental Physics, University of Science and Technology of China; Jiang Desheng [3068 1795 3932] of the Institute of Semiconductors, Chinese Academy of Sciences]

[Text] Photoreflectance (PR) spectra of GaAs-AlAs multiple quantum well (MQW) structures at room temperature are measured and compared with the photoluminescence excitation spectrum at 2K. The results show that the excitonic process is very important for GaAs-AlAs MQWs, even at room temperature. The PR modulation mechanism of GaAs-AlAs MQW structures is discussed. It is pointed out that the PR modulation is mainly caused by the optical modulation of the surface electric field. In contrast to the case of bulk materials, the PR spectra of MQWs are mainly of the first derivative functional line shapes. Under low field conditions, they are dominated by stark shifts of quantized subbands and corresponding excitonic energy gaps.

\* Project supported by the National Natural Science Fund.

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SCATTERING OF NORMALLY INCIDENT RAYLEIGH WAVE FROM SINGLE STRIP IN SHORT-CIRCUITED METALLIC GRATING ON PIEZOELECTRIC CRYSTAL SURFACE

40090121a Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4, Jul 88 pp 253-259

[English abstract of article by Sun Baoshen [1327 1403 3947], et al., of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] Starting from the piezoelectric crystal kinetic equation and other fundamental equations, the authors analyze the distribution of both the electric potential and charge on the grating induced by the incident wave with electrical perturbation technique to the crystal surface. A general integral formula of the scattered field is then obtained through integral transformation, with the electric charge induced by the incident wave acting as the exciting source.

The scattered SAW field on YZ-LiNbO<sub>3</sub> is then numerically calculated and the relationship between the reflective or forward scattering coefficients and the width of the strip is given. In addition, the change in the incident wave velocity when passing through the grating is obtained. The agreement between the authors' theory and the experimental results is good.

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LIMITED ANGLE DIFFRACTION TOMOGRAPHY FOR OBJECTS WITH PLANAR STRUCTURE

40090121b Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4,  
Jul 88 pp 265-270

[English abstract of article by Lan Congqing [5695 1783 1987], et al., of  
Wuhan Institute of Physics, Chinese Academy of Sciences]

[Text] This paper introduces a new algorithm--the linear algebraic method--for reconstructing tomograms of tested objects with planar structures. Computer simulation for reconstructing a two-layered object using two projections has been done. For the case of a limited angle, the authors apply a special pseudo-inverse filtering to the ill-posed problem in solving sets of linear algebraic simultaneous equations. Simulation results show that a 10-layered object can be reconstructed with only 19 projections having angles ranging from  $-8^\circ$  to  $8^\circ$ .

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TRANSIENT PARAMETRIC ARRAYS. 2. TWO KINDS OF PRIMARY ENVELOPES

40090121c Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4,  
Jul 88 pp 271-278

[English abstract of article by Qian Zuwen [6929 4371 2429] of the Institute  
of Acoustics, Chinese Academy of Sciences]

[Text] In this paper, two kinds of primary envelopes which are close to actual conditions are suggested, and the transient parametric pressure waveforms as well as their spectra resulting from the self-demodulation of pulses are investigated. It is shown that the spectral components referring to the first kind of primary envelopes are in the higher frequency domain. However, for the second kind of primary envelopes, in addition to the above-mentioned spectral components, more components in the lower frequency domain are contained. When a pulse train is available, the spectrum of parametric pressure has a periodic variability with its pulse duration ratio.

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EXPERIMENTAL INVESTIGATION OF TRANSIENT PARAMETRIC ARRAYS

40090121d Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4,  
Jul 88 pp 279-283

[English abstract of article by Shao Daoyuan [6730 6670 6678], et al., of the  
Institute of Acoustics, Chinese Academy of Sciences]

[Text] In this paper an experimental study of the self-demodulation of the pulse train with a sinusoidal carrier is presented. Some of the results are as follows: (1) when the duration ratio is less than 1, parametric pressure has a maximum and minimum varying with an increase in the duration ratio, and the number and location of extreme values are dependent on the repetition frequency, the center frequency of the filter and its bandwidth, (2) if the duration ratio is so little that the width of a single pulse in the train is quite narrow, the waveform of the parametric signal will be asymmetrical about the time axis and (3) if the duration ratio is equal to 1, its parametric waveform will become two N-shape pulses located at the edges of the primary pulses, respectively.

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HORIZONTAL DIRECTIVITY, SYNTHESIS OF ARC ARRAY

40090121e Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4,  
Jul 88 pp 284-290

[English abstract of article by Lan Jun [5695 6511] of the Institute of  
Acoustics, Chinese Academy of Sciences]

[Text] In this paper the horizontal directivity of an arc array is discussed in detail using the stationary phase method, and more accurate formulae of the main beam width and average pressure within the main beam are given. The methods of amplitude shading and unequally spaced array, given in this paper, can be used successfully to resolve the problem involving the more obvious fluctuation of directivity functions within the main beam and, at the same time, keep the main beam width and average pressure within the main beam approximately constant.

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HIGH-AMPLITUDE PIEZOELECTRIC SANDWICH TRANSDUCER

40090121f Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 4,  
Jul 88 pp 312-315

[English abstract of article by Lin Zhongmao [2651 0112 5399], et al., of the  
Institute of Acoustics, Chinese Academy of Sciences]

[Text] A piezoelectric transducer consisting of  $n$  elements is described by one-dimensional theory. By means of transfer matrix operations, a computer program has been made to calculate the resonant frequencies of the transducer and the displacement distribution along its axis. It is shown that the maximum ratio of the amplitude at the radiating surface to that at the backing of the transducer can be obtained under the optimal length ratio of the transducer  $L_5/(L_3 + L_4)$ . When the theoretical results are compared with the measured ones, the two agree fairly well.

9717

STRUCTURAL RELAXATION, CRYSTALLIZATION, UPPER CRITICAL FIELDS IN  
SUPERCONDUCTING METALLIC GLASS  $Zr_{66.7}Ni_{33.3}$

40090114a Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE  
PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 98-105

[English abstract of article by Zhao Yong [6392 0516], et al., of the  
Department of Physics, University of Science and Technology of China, Hefei]

[Text] Through isochronal annealing of the metallic glass  $Zr_{66.7}Ni_{33.3}$ , it has  
been found that, when the samples are in the range of structural relaxation,  
the upper critical fields and their transition widths decrease linearly with  
the annealing temperature, but the upper critical fields vary exponentially  
with the annealing temperature during the crystallization. Gibbs' theory of  
structural relaxation is modified to describe the entire annealing process,  
including structural relaxation and crystallization. The theoretical and  
experimental results are found to be in good agreement.

9717

METALLURGICAL, SUPERCONDUCTING PROPERTIES OF BRONZE-MF  $\text{Nb}_3\text{Sn}$  CONDUCTOR ABLE TO PRODUCE 15T FIELD

40090114b Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 116-123

[English abstract of article by Tang Xiande [0781 0341 1795], et al., of Baoji Institute for Non-ferrous Metal Research]

[Text] In this paper, the metallurgical and superconducting properties of a practical multifilament  $\text{Nb}_3\text{Sn}$  conductor prepared by the bronze process are reported and discussed. The experimental results show that at 4.2 K,  $J_c$  (bronze + Nb) of the conductor is up to  $9 \times 10^4 \text{ A/cm}^2$  (at 10 T),  $5.8 \times 10^4 \text{ A/cm}^2$  (at 12 T), and  $1.7 \times 10^4 \text{ A/cm}^2$  (at 16 T);  $H_{c2}$  is found to be  $\sim 22 \text{ T}$  and  $\sim 23.8 \text{ T}$ , respectively, at 4.2 K and 2.18 K, and  $T_c$  is at 17.5-17.8 K. When the bending diameter is equal to or more than 100 times as large as that of the conductor,  $J_c$  does not degenerate. Using the wind and react method, the authors have successfully fabricated a MF  $\text{Nb}_3\text{Sn}$  solenoid superconducting magnet. It is in a background field of 12.8 T. The quenching current is 32.3 A and the total magnetic field is 15.2 T. The research results suggest that using this conductor makes it possible to fabricate practical high field magnets of 15 T.

9717

GROWTH OF  $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$  SINGLE CRYSTALS

40090114c Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 127-130

[English abstract of article by Yao Lianzeng [1202 6647 1073], et al., of the University of Science and Technology of China, Hefei]

[Text]  $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$  single crystals have been grown using the slow cooling flux method, with the largest crystal obtained being about  $2 \times 1 \times 0.5 \text{ mm}^3$ . X-ray powder diffraction and a Laue photograph of the grain grown have confirmed that the grain is a  $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$  single crystal. Diamagnetic measurements show that the  $T_c$  of the single crystal is 90.5 K. Some phenomena observed during the growing process are also discussed.

9717

SUPERCONDUCTING PROPERTIES OF Mo-Re ALLOYS, Re THIN FILMS PREPARED ON ROOM TEMPERATURE SUBSTRATE

40090114d Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 131-134

[English abstract of article by Wang Ruilan [3769 3843 5695], et al., of the Institute of Physics, Chinese Academy of Sciences, Beijing]

[Text] The superconducting properties of Mo-Re alloys and Re thin films prepared on room temperature substrates by electron beam evaporation in an oil-free UHV system are presented. The maximum transition temperature of the Mo-Re alloy film is 9.97 K, and the minimum transition width is 0.1 K. The maximum transition temperature of Re thin films is 7.29 K with transition width 0.26 K. The influence of the preparation conditions on the superconducting properties of the film is discussed.

9717

SUPERCONDUCTIVITY

STUDY OF SUPERCONDUCTING LEAD THIN FILM DEPOSITION BY HIGH POWER CO<sub>2</sub> CW LASER

40090114e Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 135-139

[English abstract of article by Cai Yiming [5591 0001 7686], et al., of the Department of Physics, Fudan University, Shanghai]

[Text] A CO<sub>2</sub> CW laser coating device which can free optical units from contamination has been designed and installed. Superconducting lead thin films have been deposited using this device. Compared with the conventional thermal method for making Pb films, the high power CO<sub>2</sub> CW laser coating method has the advantage of producing superconducting Pb thin films with better crystallinity and less contamination.

9717



DESIGN, MANUFACTURE OF  $\text{Nb}_3\text{Sn}$  SUPERCONDUCTING MAGNET

40090114f Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 10 No 2, Jun 88 pp 146-149

[English abstract of article by Hu Shanrong [5170 0810 2837], et al., of Shanghai Institute of Metallurgy, Chinese Academy of Sciences]

[Text] This paper reports the use of the BASIC program to calculate the field strength and homogeneity of the solenoid superconducting magnet, giving the geometric size of and wire needed for the inner magnet in the composite magnetic system for different field homogeneity requirements. The fabrication technology and some measurements of the inner magnet made of the multifilament  $\text{Nb}_3\text{Sn}$  composite conductor are given in the example. They are applicable to the fabrication of the  $\text{Nb}_3\text{Sn}$  superconducting magnet.

9717

Double-Object Program and Its Applications in CAS of Microwave Circuits

40090099a Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 9-14

[Article by Liang Changhong [2733 2490 3163] and Guan Boran [1351 0130 3544] of Northwest Telecommunications Engineering Institute]

[Abstract] In recent years, a new branch of computer-aided synthesis (CAS) has come into existence, combining optimization theory and microwave engineering. Difficult to tackle in the past, a number of problems have been solved. Naturally, analytical theory still has a high standing and function even in today's environment with the rapid advances in computer technology. As to the optimization method usually confronted in engineering projects, an appropriate mathematical model should be first proposed. This approach depends on objectively realizing the topic and depth in analytical research. Generally the optimization problems confronted in microwave engineering projects can be divided into single-, double- and multiple-object programs.

The paper presents the general concepts in a double-object optimization program. The extreme-bandwidths criterion of a contradictory double-object is developed. Some optimization examples are given for an arbitrary branch-guide directional coupler.

Five figures show frequency-band curves, branch-guide directional coupler, and response curves corresponding to single-, double- and triple-branch directional couplers. Three tables list the parameters of these couplers. References: 7, in English and Chinese.

Liang Changhong is a professor in the department of electromagnetic engineering and concurrently assistant to the dean at the Northwest Telecommunications Engineering Institute. Liang completed his postgraduate research at the institute in 1967. From 1980 to 1982, he was in the United States for advanced studies at Syracuse University. Currently, he is teaching and is conducting research in computational microwave technology, energy transfer electromagnetism, and isolated particles. Liang is the author of WEIBO WANGLUO JIQI YINGYONG [Microwave Network and Its Applications] and JISUAN WEIBO [Computational Microwave Technology].

Guan Boran is an instructor at the department of electromagnetic engineering. He was awarded a master's degree in electromagnetic fields and microwave technology. Currently he is conducting research and is teaching on electromagnetic isolated particles.

The paper was received for publication on 5 December 1986.

10424/6091

Class E High-Efficiency Tuned Power Oscillator

40090099b Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 15-22

[Article by Li Bixia and Yang Guoxiong of Chengdu Institute of Radio Engineering]

[Abstract] The paper presents a class E high-efficiency transistor tuned power oscillator. The operating conditions of the oscillator are formulated. The effects of variations in component parameters are determined. Numerical results show that the oscillator is quite tolerant of reasonable circuit variations. The authors proposed a new method--the improved harmonic balance method--for the solution of strongly nonlinear periodic circuits. The method was used for class E oscillators; satisfactory results were obtained. The overall efficiencies of a class E oscillator with 2.5 watt output at 2 MHz, using the computer simulation and experiment approaches, were found to be 89 and 85 percent, respectively. These two percentage figures agree fairly well.

Five figures show a class E oscillator, its mathematical model and equivalent circuit, an imaginary voltage source added to linear and nonlinear sub-networks, algorithm flowchart, and an experimental circuit. Four tables list data of the analytical results of a transcendental equation, component parameters of the load network, a comparison of data between theoretical and simulation computations, and data comparing experimental results and computer analyses. References: 7, in English and Chinese.

The paper was received for publication on 25 December 1986.

10424/6091

An Approach for Matching a Planar Scene by Arrays of Points

40090099c Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 31-36, 14

[Article by Jing Renjie [5427 0088 2638] and Chen Yang [7115 3152] of Department of Information and Electronic Engineering, Zhejiang University]

[Abstract] The paper presents a new approach for finding the corresponding corner points between two perspective views of a moving planar scene and each point is featured by its parameters. Then a relaxation algorithm is used to enhance the matching confidence level. The process will be iterated until the largest matched point set is obtained. Several tests were made and the results show that this approach works well.

Generally speaking, here are the steps for structural matching: 1) Local features of a picture (such as line, intersection point and loop) are chosen with a certain property or mark placed for the chosen feature. 2) All possible corresponding relations (so-called general matching) are sought according to the type of particular feature. 3) Based on the geometric relations, topological relations or consistency of marks, the maximum matching set or subset (so-called general matching) corresponding to the local matching is found.

Six figures show the angular point (and its matching condition), direction, template, projection imaging model, aerial photographs, and sub-photographs. Four tables show data of the angular point parameters, matching results, and statistics. References: 9, in English.

Jing Renjie is an associate professor and concurrently chief of the faculty research laboratory in the Department of Information and Electronic Engineering. Jing was graduated from the Department of Radio Engineering, Qinghua University in 1955; he presented more than 10 papers at annual symposiums in China and elsewhere. Currently, Jing is engaged in research and teaching on countrywide land resources sensing, computer vision and artificial intelligence. Chen Yang is a lecturer at the Department of Information and Electronic Engineering. Chen was awarded a master's degree at the Department of Communication and Electronic Engineering, Zhejiang University. He presented two papers in domestic (China) symposiums.

The paper was funded by the State Natural Science Fund.

10424/6091

New Advances in Nonlinear Digital Filters

40090099d Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 37-44, 22

[Article by Ding Runtao [0002 3387 3447], Tianjin University]

[Abstract] Compared with linear filtration technique, the advent of nonlinear filtration is quite recent. This has a kind of nonlinear reflection relationship with respect to the input signal sequence. To a certain extent, a nonlinear filter is free of the shortcomings in linear filters.

In recent years, many ad hoc nonlinear digital filters for signal processing were remarkably developed with astounding capabilities. This paper presents advances in research on nonlinear filters, classifies the fundamental methods, and points out limitations of present methods. Finally, the trend and outlook for future advances are described. Two of the authors' papers present an adaptive order statistic algorithm capable of simultaneously filtering multiple kinds of noise; the simulation results are shown in the only text figure.

The paper describes progress in median filters, order statistic filters, nonlinear mean (NLM) filters, and other nonlinear filters (such as quadratic and local statistics filters). The research was funded by the (Chinese) State Natural Science Fund. References: 85, 83 in English and 2 in Chinese.

The author is an associate professor at the Department of Electronic Engineering, Tianjin University; he was graduated from the Department of Precision Instruments at the university in 1961. From 1984 to 1986, he was at Toronto University, Canada, for advanced studies. Currently, the author is engaged in research and teaching on signals and systems, as well as on signal and graphic processing.

10424/6091

Pattern Block Matching Coding for Digital Images

40090099e Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 45-53

[Article by Yang Xuejun [2799 1331 6571], Cai Dejun [5591 1795 6874], and Huang Zailu [7806 6528 4389] of Huazhong University of Science and Technology]

[Abstract] The paper presents a new approach to image-data compression coding. The principle involves an optimal approach to the image block with the designed pattern block. The compression ratio realized is 0.875 bit/pixel with better objective and subjective image quality; the operational volume is relatively small. The paper describes the principle of pattern block design, pattern block recognition and coding. Results of computer simulation experiments are given.

Selection of pattern block form directly relates to the quality of the coding graph and algorithmic complexity. The following three factors should be considered: 1) inherent structure of the graph, 2) convenience in recognition and approach, and 3) equal code length structure, if possible, while stringing is realized.

Thirteen figures show a linear variation subgraph with  $G$  as the gradient value, a pattern block, coordinate system, statistical curves for mean gradient values, pattern block design, a coordinate system for a  $4 \times 4$  subgraph, six boundary forms, probability distribution, coding graphs, and graphs produced with simulation coding experiments. Five tables list data of gradient values and determination limits, estimated values of the quantified power level, experimental graph data, and operating volume required for an average picture element. References: 5, 4 in English and 1 in Chinese.

The paper was received for publication on 16 December 1985.

10424/6091

New Recursive Optimal Filtering of One-Dimensional Stationary Random Processes

40090099f Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 64-70

[Article by Wang Hongyu [3769 1347 4416] and Liu Weidong [0491 5898 2639] of Dalian Engineering Institute]

[Abstract] The paper proposes a method for recursive optimal filtering of one-dimensional stationary random processes by using Kalman filtering of a constant system. The method involves approaching a known irrational power spectral density (PSD) by a rational PSD at first, and then obtaining the ARMA [autoregressive moving average] model by multiplicative spectral decomposition of the rational spectrum. Kalman recursive filtering formulations of a constant system can be used by converting the ARMA model into a Markov state space model in the form of expanded dimensionality. As shown in a block diagram, the simulation results are presented and recursive optimal filtering is compared with Wiener filtering. In the numerical computation, it is shown that the two filters have the same results.

Both Wiener and Kalman filtering techniques are linear without deviation as the optimal filtering under the error significance existing in the least mean squares technique. Wiener filtering is adaptable to moderate situations; Kalman filtering is adaptable to both steady and unsteady situations.

In separate sections, the paper describes the time sequence model and the state space model, the relations between the power spectrum and the time sequence model, and results of simulation computation. References: 4, 3 in Chinese and 1 in German.

Wang Hongyu is a professor in the Department of Electronic Engineering, Dalian Engineering Institute; concurrently he is director of the Information Technology Department at the institute. Liu Weidong is a teaching assistant at the Institute of Information and Control Science, Xi'an Jiatong University; he was awarded a master's degree at Dalian Engineering Institute in 1986.

The paper was received for publication on 18 July 1986.

10424/6091



Copy Theory of Walsh Function and Its Application in Rademacher/Walsh Transform Matrix

40090099g Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9 No 2, Mar 88 pp 71-76

[Article by Liu Xinping [0491 1800 1627], Beijing Institute of Aeronautics and Astronautics]

[Abstract] As early as the late 1960's, D.A. Swick proposed Walsh function duplication; utilizing the symmetric relations of the Walsh function, the function can be obtained with image duplication while the code of the sequence number is used as duplication information. This method is simple and can be easily executed; however, not much interest was shown to the method then. The paper closely examines the Copy Theory of Walsh Function, applied in the Rademacher/Walsh transform matrix. A new concept of copy distance and a new viewpoint forming generated sequence involving exclusive OR operation are discussed. In addition, it is pointed out that ideal copy information is central to the application of the Copy Theory in the Rademacher/Walsh transform for a single-pass forming matrix  $[W_{RO}]$ . The Walsh Copy Theory can be described with six parameters: original sequence, number of copy times (P), copy mode, copy distance (D), copy information (m), and generated sequence.

The transform matrix analysis of Boolean functions is discussed in one section of the paper. Another section deals with selection of copy information as related to the symmetric copy mode and translational copy mode. Three figures show symmetric and translational copy modes, as well as the leftward cyclic code. Two tables show copy processes of symmetric and translational copy modes. References: 3, 2 in Chinese and 1 in English.

The paper was received for publication on 2 March 1987.

10424/6091

New Method for Passive Clock Synchronization and Self-Positioning of a Time-Division Multiple-Access Communication and Position-Locating System

40090099h Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese Vol 9. No 2, Mar 88 pp 89-93

[Article by Xiang Yang [7309 7122] and Yang Shaopeng [2799 4801 7720] of Beijing Institute of Aeronautics and Astronautics]

[Abstract] A new mathematical method is devised for calculating passive unknown coordinate clock synchronization and self-position locating of user terminals in a time-division multiple-access communication and position-locating system: the user-motion equation, uniform transmission-rate method is devised. Using this method, the authors tested the real-time processing of clock synchronization and position locating through system for user terminal and a real-time environmental simulator. The experimental results of real-time processing are given in the paper.

Below, Figure 1 shows the distribution of users in a uniform transmission rate system; Figure 2 shows two models: a variable and a uniform transmission rate model.

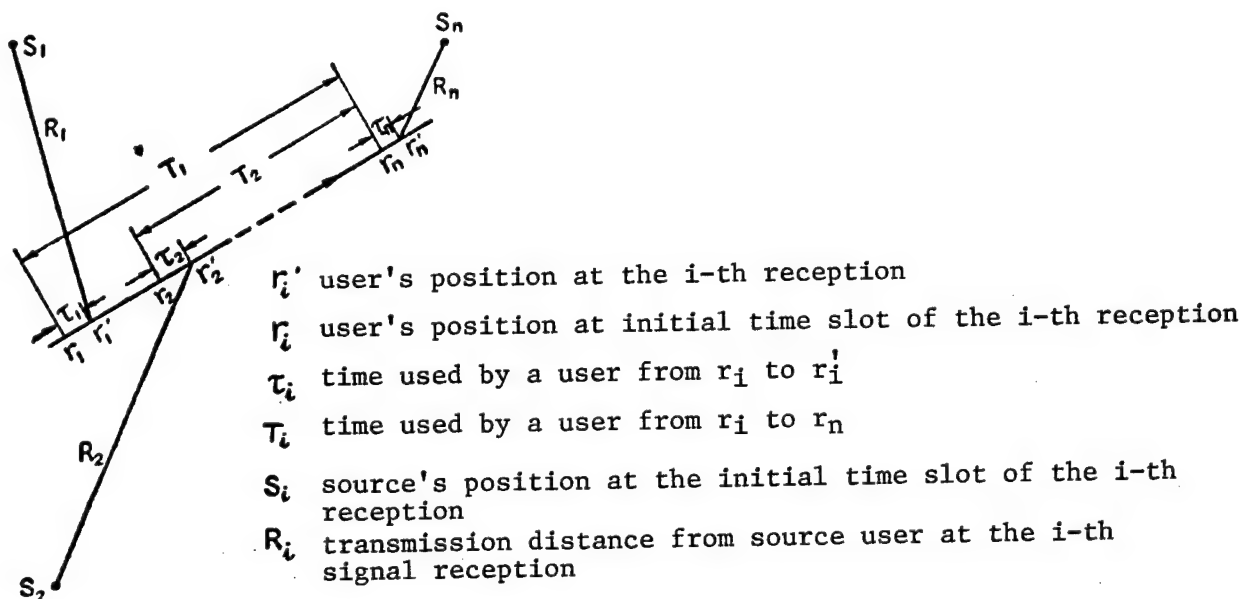


Figure 1



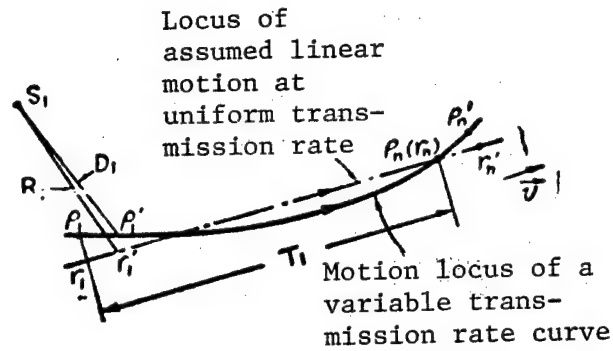


Figure 2

In the improvements made by the authors on the SDZX-1 positioning system in time division multiple access (TDMA) digital communication, user clocks were synchronized and position-locating was processed in real time; on-line testing of the uniform transmission-rate method of the system environment simulator was carried out with prototype laboratory machines at user terminals. The block diagram of the SDZX-1 system is shown in Figure 3.

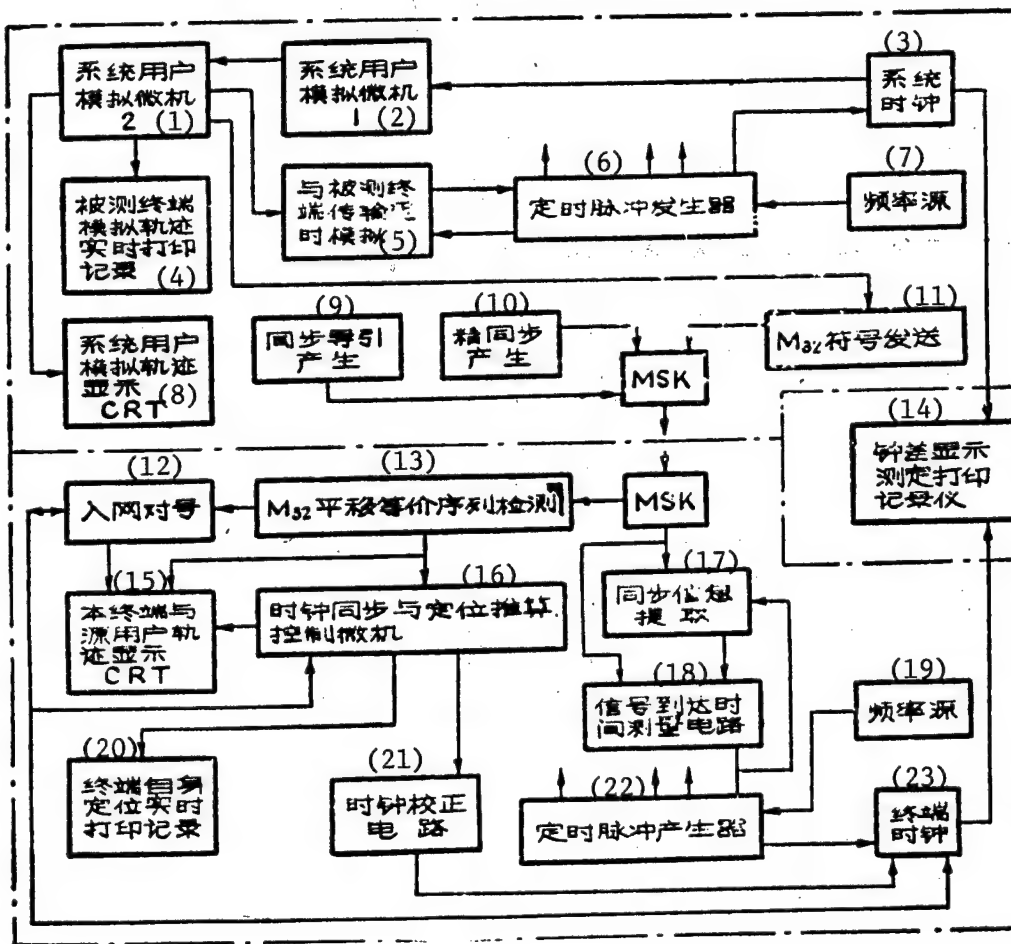


Figure 3

[Key on following page]

Key:

1. Simulation microcomputer 2 of system user
2. Simulation microcomputer 1 of system user
3. System clock
4. Real-time printout of simulation locus at the terminal tested
5. Transmission time lag simulation with the terminal tested
6. Timing-pulse generator
7. Frequency source
8. Simulation locus display CRT of system user
9. Generation of synchronous guidance
10. Generation of precision synchronization
11. M32 symbol transmission
12. Sequence check in networking
13. Examination of M32 translational equivalent sequence
14. Printout instrument for clock-difference display determination
15. Locus display CRT of this terminal and source user
16. Control microcomputer for clock synchronization and positioning computation
17. Extraction of synchronizing data
18. Measuring circuit for signal-arrival time
19. Frequency source
20. Real-time printout for self-positioning of terminal
21. Clock calibration circuit
22. Timing-pulse generator
23. Terminal clock

Four more figures show the CRT display of simulation loci of a simulator system user, random phase (and clock post-synchronization) of terminal clock relative to system clock, and CRT loci display at the terminal.

The authors are grateful to Associate Professor Li Minghong at the Beijing Institute of Aeronautics and Astronautics for his assistance. Xiang Yang was awarded a master's degree in 1985 at this institute; he is currently studying for a doctoral degree in Canada. Yang Shaopeng is an associate professor at the institute; he is engaged in research and teaching on communications and electronic systems.

The paper was received for publication on 13 September 1986.

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3. A.M. Schnoider, Observability of Relative Navigation Using Range-Only Measurements, IEEE PLANS 82, pp 148-158.

10424/6091

# Rapid Growth Seen in Millimeter-Wave Research, Development

40080141a Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE & TECHNOLOGY] in Chinese Vol 18 No 5, May 88 pp 10-12

[Article by Liao Fujiang [1675 1788 1735], Institute 12, Ministry of Electronics Industry]

[Excerpts] In the last few years, China's millimeter-wave technology has developed rapidly; the fruits of [our] gyrotron research have already attracted the attention of several countries in the world. Practical gains have been made in other millimeter-wave electronic devices such as klystrons, backward wave tubes, extended interaction amplifiers and oscillators. The upper frequency limit of IMPATT [impact avalanche and transit time] diodes and oscillators has now exceeded 100 GHz, and the development of [millimeter-wave] GaAs monolithic integrated circuits [MIMIC] has also seen great advances. Some millimeter-wave devices and test systems are already in batch production. In general, however, quite a gap still exists between China and the state of the art; an organized effort to carry out research on a broader scale throughout the country has not yet materialized.

In the area of power sources, the output power of the 8-mm gyrotron has reached 100 kW, and wave-heating experiments have been conducted. The operating frequency of GUNN oscillators has reached 140 GHz, and the noise figure of Schottky diodes has been reduced to a level of 6.5 dB or less in the 4-6-mm range. China has also developed a 94-GHz radio telescope and a pleochrometer for [plasma] diagnosis in tokamaks. These achievements are indications that China already has a good foundation for developing millimeter-wave technology and has established a highly-qualified team of technical personnel. With the rapid growth in millimeter-wave technology, an increasing number of millimeter-wave electronic apparatus will undoubtedly be developed. In order to meet the needs of modern warfare, we must increase our investment in millimeter-wave technology development, establish a comprehensive development plan, intensify our efforts in basic research, and follow a systematic course in developing millimeter-wave electronic equipment for military applications.

3012/6091

Current Status, Progress in Development of Space Telemetry, Control Technology

40080141b Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE & TECHNOLOGY] in Chinese Vol 18 No 5, May 88 pp 13-14, 9

[Article by Guo Zhigang [6753 1807 6921], Institute 10, Ministry of Electronics Industry]

[Text] This article summarizes the current status of China's space telemetry and control system, and the progress in developing the next-generation system.

I. Introduction

In 1984 and 1986, China successively launched two geosynchronous communication satellites (experimental and operational) located respectively at 125°E and 103°E above the equator. The success of these launches attracted international attention. The telemetry and control system used by the aerospace industry for these satellite launches was completely designed and built by Chinese engineers. Because of the technical complexity and the wide range of disciplines involved in the system, development of the system was divided into several tasks assigned to seven different organizations. This system is capable of performing various functions required for the launch of a geosynchronous satellite, including position determination, attitude determination, monitoring of on-board engineering parameters, attitude adjustment, orbit transfer, switching control, as well as data transmission between two stations via the satellite. Therefore, it has the capability of tracking (including range, velocity, and angle measurements), remote control, and coded and analog telemetry.

II. System Configuration and Technical Performance of the Telemetry and Control System

1. System Configuration and Technical Performance

The configurations of early telemetry and control systems were mostly of a dispersed design; i.e., the orbit determination function, the telemetry function and the remote control function were performed by autonomous subsystems, each with its own antenna, transmitters, receivers and terminal equipment. But this design resulted in a very complex and costly system,

and the on-board electronic equipment became a major segment of the satellite payload. With the advancement in technology, modern telemetry and control systems all use an integrated-channel configuration, where the baseband signals of each function are modulated onto subcarriers, which are in turn modulated onto a single carrier. Consequently, the ground telemetry and control system and the satellite transponder each requires only one set of antenna and one transmit/receive channel. This configuration not only reduces the required investment in ground equipment, but also reduces the volume, weight and power consumption of the on-board equipment. Thus, for a given design constraint in volume and weight, the satellite will have a higher communication capacity, and potential interferences between the subsystems can be avoided.

The orbit determination measurements in this country are performed by a single station, whereas multiple stations are used by most other countries. Although China has two stations, they are primarily designed to improve system reliability. Also, because of political constraints, no attempt was made to pursue international cooperation, not to mention the possibility of establishing telemetry and control stations abroad. Due to the close proximity of the two stations, they essentially can only measure parameters over the same orbit segment, and therefore do not provide the geometric advantage of two stations.

However, with the high-precision measurements and the high-speed data processing capability, it is possible to predict the attitude of the 4th-stage engine ignition during the second transfer orbit, and hence the time required for the satellite to reach its final position is reduced. The performance parameters of the ground telemetry and control system are as follows: systematic error in angle measurement--less than 0.2 mil, random error--less than 0.1 mil; systematic error in range measurement--3-5 m, random error--3 m; error in velocity measurement--2.0 cm/sec (sampling interval 40 ms); satellite attitude control error--0.1°.

A brief description of each subsystem design is given below.

## 2. Range Measurement Subsystem

This subsystem uses a combined pseudo-code and side-tone signal format. Its accuracy is primarily determined by the phase noise of the side-tone and the system phase drift; in other words, it is determined by the signal-to-noise ratio (SNR) of the side-tone and variation in the system time delay. In order to improve ranging accuracy, Doppler compensation and narrow-band phase-locked-loop (PLL) techniques are used. Specifically, the Doppler frequency of the side-tone is first removed through frequency combining, then it is passed through a PLL and finally reconstructed to produce a side-tone with Doppler frequency. This process greatly enhances the SNR of the side-tone; the phase noise of the measured side-tone is approximately 1°. In addition, with Doppler compensation, the SNR requirement of the input signal is reduced; hence, the side-tone input filter can have a relatively wide bandwidth to ensure phase linearity, which will limit fluctuations in the group delay and thus improve the systematic error in range measurement.



### 3. Velocity Measurement Subsystem

The error in velocity measurement is a performance parameter of the overall system. While it is a function of the subsystem accuracy, it also depends on the short-term frequency stability of the transmitter and the first-stage local oscillator of the receiver. The velocity measurement subsystem uses an integer-cycle design with fixed-integer sampling for measuring Doppler frequency; its systematic error is less than 0.6 cm/sec. The frequency source of the transmitter is based on a design of summing large and small numbers, where 99 percent of the frequency components are generated by a crystal oscillator, and the small numbers are generated by a digital frequency synthesizer. This design allows the operating frequency of the transmitter to be varied without violating the short-term stability requirement of  $1 \times 10^{-10}$ /sec (sampling at 40 ms intervals). The receiver uses a PLL design in the second-stage oscillator; the first-stage local oscillator is independent of the main PLL. This design was chosen for the following reasons: First, it allows the operating frequency of the station to be varied by merely changing the frequency of the first-stage local oscillator without changing any parameter in the main PLL; thus, the performance parameters of this loop are not affected. Second, the crystal oscillation, frequency multiplication and the lock insertion of the first-stage oscillator provide higher short-term stability. In designing crystal oscillator circuits, long-term and short-term frequency stability generally pose conflicting requirements; in this case, we are primarily concerned with the short-term stability of the first-stage oscillator; the frequency drift caused by long-term stability can be compensated in the design of the Doppler processing unit. Because of the high short-term stability of the receiver and the transmitter, and the relatively small error in the velocity measurement subsystem, highly accurate velocity measurements can be achieved.

### 4. Angle Measurement Subsystem

In order to ensure high accuracy in angle measurement, great care is taken in designing the feed, the antenna, and the antenna mount, and an advance signal recurrence design is implemented in the servo system. This design can dramatically reduce the lag time in angle tracking and therefore improve the tracking performance of fast-moving targets. In addition, stringent requirements are imposed on the receiver design. According to the principle of monopulse radar, the angular error output of the receiver represents the angular deviation of the target from the beam center. Therefore, under ideal conditions, the angular error caused by the same angle deviation should be independent of fluctuations in the signal level. Actual performance results indicate that when the input signal level varies by 50 dB, the output of the receiver with automatic gain control varies by  $\pm 0.5$  dB, and the phase variation is  $3^\circ$ . The accuracy of angle measurement can be further improved by establishing a correction model from calibration data.

## 5. Telemetry and Remote Control Subsystem

The accuracy of the analog telemetry is mainly determined by the phase accuracy of the attitude pulse, while the accuracy of the coded telemetry is determined by the code error rate. In order to meet the accuracy requirement, the signal-to-noise power density ratio of each of the demodulated subcarriers must reach some specified value. At the rated sensitivity level, the demodulators operate at -17 dB SNR, and under extreme sensitivity conditions, the SNR is -20 dB. This presents a difficult problem for receiver design.

The remote-control subsystem uses a large-loop return-check design, where the control command received at the satellite is sent back to the ground station via coded telemetry and compared with the original command. If an error exists between the two, then the command is re-transmitted; this scheme can almost completely eliminate any error in the transmitted signal. The spin simulator of the synchronous controller uses a second-order digital tracking loop design which has a short locking time, and can accommodate a wide range of angular speeds with an accuracy of less than  $0.1^\circ$ .

In order to facilitate the acquisition of targets in flight, the receiver is equipped with a frequency guidance unit which can capture a target's frequency within 0.2 seconds after it is detected by the antenna beam and begin angle-tracking. This provides the ground station with good target acquisition capability.

### III. Efforts To Improve Reliability and Stability

Advanced technical performance without a high degree of reliability is meaningless. The ground telemetry and control station has approximately 120,000 domestically produced components. The required mean time to failure for the system is 50 hours (the requirement for the major subsystems is 600 hours); the actual mean time to failure is approximately 200 hours, and the system operated without failure during the actual missions.

#### 1. Efforts To Improve Reliability

(1) Use of Back-Up Heat Unit. The failure rate of early Chinese-made components was approximately  $1 \times 10^{-5}/\text{hr}$ , which was several orders of magnitude higher than components made in other countries. For this reason, the system has a back-up heat unit which can be switched into service in case of a malfunction in the primary unit. The interfaces of the subunits are designed such that no adjustment is necessary during switching. After switching, the system can continue normal operation without losing lock in the main PLL and without losing track.

(2) Careful Screening and Below-Rating Usage of Components. In order to eliminate components which are subject to early failures, all components are carefully screened according to some specified conditions. Also, it is required that the actual voltage, current and power during operation are

lower than the factory-rated values; this is the so-called below-rating usage. These measures proved very effective in improving unit reliability.

(3) Thermal Design. Both theoretical and experimental results have shown that rising environmental temperature has an adverse effect on component reliability. Therefore, the structural design must include thermal design in order to prevent the interior temperature from rising.

In addition, quality inspection must be carried out during each phase of the development process, and the finished unit must undergo aging tests to further eliminate components subject to early failures.

## 2. Efforts To Improve Stability

In addition to reliability, another important consideration in system design is stability, which requires that the measured performance is repeatable over an extended period. According to statistics collected over a period of 99 hours of operation, no adjustment was required in either the amplitude and phase of the uplink modulator and downlink wide-band demodulator, or in the two angle error detector channels, or in the ranging codes and side-tones. During the period from 8 April to 17 April 1984, repeated measurements were made of the zero values of range and angle error channels; the results showed that the average variation in the zero range values is less than 1.5 m, and the angle error is less than  $5 \times 10^{-3}$  deg. According to specification, it is only required to maintain stable zero values for 10 hours of continuous operation because a zero correction can be made before each system operation. The following measures were taken to improve stability:

(1) Environment Simulation Test. After the completion of special tests and subsystem tests, the system must undergo environment simulation test to ensure that the components can meet performance requirements over the range of operating temperatures and humidity levels, and that they will not be damaged during shipping.

(2) Protection Against Noise and Interference in the Electrical Circuit. In order to protect the system against power surge and interference peaks in the electrical circuit, and fluctuations in the source voltage, a filter is added to the input terminal of the power box; also, the system uses voltage regulators, parametric voltage stabilizers and voltage-stabilized switching source.

(3) Anti-Electromagnetic Interference. Provisions for shielding against electromagnetic interference are incorporated in the system design as well as in the construction of the ground station; before final installation, the system is tested for its anti-electromagnetic interference capability. Other measures include specifying the relationship between the ground and the 50-Hz power source, and specifying the circuit layout inside the power box, etc.

#### IV. Progress in the Development of Next-Generation Telemetry and Control System

To meet the needs of China's aerospace industry and the needs of international cooperation, the next-generation telemetry and control system will soon be in service. It incorporates the experience gained in developing and operating the first-generation system, and uses new components built in the 1980's which are of much higher quality than those built in the 1970's. Furthermore, as a result of the open-door policy, certain components can be imported from abroad, which also facilitated the development of the new system. The main feature of the new system is to fully utilize microcomputers and medium-to-large-scale integrated circuits. In particular, microcomputers are used to perform such functions as fault detection, mathematical computation, subsystem operation, switching control and display, as well as data recording and certain aspects of the main control function. Therefore, the degree of automation of the new system is significantly improved. The number of power boxes in each subsystem is generally reduced, and the total number of the system is reduced by one-half. In addition, each subsystem has incorporated certain improvements; for example, the large, three-phase voltage-regulated transformer used for the high-voltage power supply for the final-stage power amplifier of the transmitter has been replaced by a small compensation voltage regulator which can be placed inside the power box to reduce the volume and weight of the transmitter. The short-term stability of the output signal has reached  $5 \times 10^{11}$ /sec. The complicated parametric amplifier of the receiver has been replaced by a FET amplifier whose electrical performance and reliability are significantly better and whose structure is simplified to facilitate maintenance and repair. The multi-crystal filter design of the frequency guidance unit has been replaced by a Fast Fourier Transform design to capture the carrier frequency. The frequency of the timing pulse has been increased from 78 MHz to 144 MHz; the inherent error in the velocity measurement subsystem has been reduced to 0.3 cm/sec, and the short-term stability of both the transmitting and receiving frequency sources has been improved to provide an overall velocity error of 1.5 cm/sec. The Doppler compensation technique used in the ranging subsystem has been replaced by a phase compensation technique of the side-tone PLL. Although the former technique proved to be effective, its implementation requires a larger number of components which implies poorer reliability and higher cost. The ranging accuracies of the two systems are almost identical; the latter system has larger random error, but it can be removed by data processing and therefore does not affect the ranging accuracy of the system. Thus, the new design clearly has definite advantages.

The above discussions show that the next-generation system is significantly improved in terms of automation, electrical performance, and structure. It will undoubtedly contribute to the future development of China's aerospace industry and be able to satisfy the needs of international cooperation.

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TELECOMMUNICATIONS R&D

Fiber Communication Cable Completed in Hubei

40100031 Beijing XINHUA in English 1237 GMT 28 Jun 88

[Text] Beijing, June 28 (XINHUA)--An optical fiber communication cable stretching 244.8 kilometers has been completed between Wuhan, the capital of Hubei Province and Jingzhou and Shashi cities to the west.

The cable is the longest built in China and features automatic relay stations powered by solar or engine power generating facilities, according to today's PEOPLE'S DAILY.

The cable has a capacity of 480 lines; 120 lines have been put into operation.

The project, which recently passed a technical appraisal by the Ministry of Posts and Telecommunications, will improve long-distance telephone service in the area and upgrade telephone transmission facilities.

The ministry plans to install more optical-fiber cables to improve telecommunications in localities, the paper said.

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## Briefs

Microcomputer Radio Communications System--The Armored Force Command Institute has developed a high-speed microcomputer radio communications system which has proved stable and reliable in unit tactical maneuvers and military training exercises. The system consists of a domestically made CWT-176 vehicle-mounted transceiver, an STM computer, an interface, an appropriate external equipment; it provides radiotelephone communications and transmission of various kinds of Chinese-character military documents, tables, graphics, data, etc. at a rate of several hundred characters per second. Transmission range is comparable to that of conventional radiotelephone communications. The system's display, storage, and printing features simplify the work of staff officers and provide increased efficiency to senior officers and other authorities. The system, which can be mounted in tired or tracked vehicles, is applicable to combat command under conditions of field operation. [Summary] [40080179a Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 22, 8 Jun 88 p 2]

Shanxi's First DMW Circuit--Shanxi Province's first digital microwave circuit will begin operation in the first half of this year between Taiyuan and Yangquan. This circuit utilizes completely Chinese-made equipment; the initial phase of the project will include 120 digital voice channels. [Text] [40080179b Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 6, Jun 88 p 48]

First Domestic Coastal Satcom Station--As a member state of Inmarsat, China is currently constructing in Beijing the first domestic satellite communication coastal ground station. This project will actively contribute to improved maritime rescue operations and to accelerated development of domestic shipping modernization. Completion of equipment connection and testing for the project is planned for the end of this year, with Chinese and foreign client commercial use to begin in early 1989. The station is located in the northwest suburbs of Beijing and occupies 1.3 hectares. Two 13-m antennas at a distance of 50 m apart will be employed--one is oriented to the Pacific Ocean, and the other to the Indian Ocean. [Text] [40080179c Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 6, Jun 88 p 48]

Shanghai's First All-Digital Exchange--A ceremony to celebrate the official opening of Shanghai's first fully digital telephone switchboard--the F-150 program-controlled switchboard system in the Wusheng Road Telephone Office located in the Telecommunications Building on People's Square--was held the day before yesterday. Vice Mayor Ni Tianzeng and representatives of Fujitsu--the company which supplied the equipment--attended the ceremony. All interoffice repeating for the system--the initial phase of which has 10,000 switches--is via optical cable and PCM digital transmission equipment. Almost 4,600 customers served by the Taixing Rd., Fenyang Rd., Yunnan Rd., Fujian Rd., and other telephone branch offices will be regulated through the Wusheng Road central office. [Summary] [40080179d Shanghai JIEFANG RIBAO in Chinese 19 Jun 88 p 2]

Satellite Newspaper Facsimile Transmission--The newspaper facsimile data compression equipment developed by the Information Engineering Department of the Beijing Posts & Telecommunications Institute--the CCJ-1 Facsimile Signal Processing Computer--was certified today by MPT. This project, begun in June 1986 and completed in June 1987, was successfully tested in January 1988 via satellite link between Beijing and Urumqi. Following approval by MPT's Directorate-General and Telecommunications, the system became formally operational in May 1988. Prior to this system, many circuits had to be used to transmit newspapers, and some areas could only be served by airmail editions. With the new system, facsimile transmission has been speeded up 5 times and quality has been improved. The new equipment utilizes several advanced technologies such as single-channel satellite transmission, digital processing, source compression encoding, full-edition information computer storage and transmission, and error control. The system has potential in information compression processing areas such as satellite weather data processing and long-distance photographic composition and printing. [Summary] [40080179e Beijing RENMIN RIBAO in Chinese 17 Jul 88 p 3]

Large-Scale Telephone Project in Guangdong--With a US\$70 million loan from the Swiss government, Guangdong Province will undertake a large-scale telephone communications project, including a municipal program-controlled 260,000-switch telephone system, long-distance program-controlled telephone switchboard equipment for 4800 lines, a three-line digital microwave trunkline for the eastern Guangdong-western Guangdong-Zhujiang triangle, as well as appropriate complete sets of equipment. Construction is to begin this year, with formal operation set for next year; at that time, Guangdong Province's telephone capacity will increase by 50 percent. [Text] [40080179f Beijing RENMIN RIBAO [PEOPLE'S DAILY] (Overseas Edition) in Chinese 27 Jul 88 p 1]

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